SCS ENGINEERS

Comprehensive Review of Solid Waste Collection and Disposal Options

Town of Chapel Hill
North Carolina

Presented to:

Town of Chapel Hill

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Table of Contents

Section **Page**

Executive Summary ES-1
Introduction ES-1
Summary of Conclusions and Recommendations ES-1
Qualitative Comparison of Program Scenarios Evaluated ES-8
Implementation Schedule ES-9
1.0 Introduction 1
1.1 Project Purpose 1
1.2 Town Goals 1
1.3 Town Governance 1
1.4 Background Information 2
1.5 Collection and Disposal Options Introduction 3
1.6 Scenario Modeling Introduction 3
2.0 Summary of Current Solid Waste Management Systems 5
2.1 Solid Waste Disposal 5
2.1.1 Current Disposal System Structure 5
2.1.1.1 Town of Chapel Hill 5
2.1.1.2 Solid Waste Advisory Board 6
2.1.1.3 Other Department Assistance 6
2.1.2 Solid Waste Disposal Quantity 6
2.1.3 Solid Waste Characterization 7
2.1.4 Town Demographics 8
2.1.4.1 Population Projection, Density, and Employment 8
2.1.4.2 Residential Customer Statistics 9
2.1.4.3 Commercial Customer Statistics 10
2.1.5 Solid Waste Disposal Costs 11
2.2 Solid Waste Collections 12
2.2.1 Collections Policies and Practices 12
2.2.1.1 Single-Family Residential Customers 12
2.2.1.2 Multi-Family Customers 13
2.2.1.3 Commercial Customers 13
2.2.1.4 Yard Waste 13
2.2.1.5 Seasonal Loose Leaf Collection 14
2.2.1.6 Food Waste/ Grease/ Oil 15
2.2.1.7 Bulky Wastes/ White Goods 15
2.2.1.8 Construction and Demolition Debris 15
2.2.2 Current Collections Route Description 16
2.2.2.1 Residential Collections – MSW and Yard Waste 16
2.2.2.2 Commercial Collections 17
2.2.3 Collections Fleet Description 18
2.2.3.1 Residential Collection 18
2.2.3.2 Commercial Collection 18

2.2.3.3 Other Vehicles and Equipment 18
2.2.3.4 Vehicle Maintenance and Repair 19
2.2.4 Collections Personnel 19
2.2.4.1 Residential Collections Personnel 19
2.2.4.2 Commercial Collections Personnel 20
2.2.4.3 Task-Based Earnings Structure and Full-Time Benefits 20
2.2.4.4 Overtime and Temporary Personnel 20
2.2.5 Solid Waste Collections Cost 20
2.3 Solid Waste Revenue 21
2.3.1 General Program Revenue 21
2.3.2 Residential Collections and Disposal 21
2.3.3 Commercial Collections and Disposal 22
2.3.3.1 Bulk Containers 22
2.3.3.2 Compactors 22
2.3.3.3 Roll-Carts 22
2.3.4 Residential and Commercial Fines 23
2.4 Current Recycling System 23
2.4.1 Summary of Waste Reduction Goals 23
2.4.2 System Description 23
2.4.2.1 Residential Recycling Programs 24
2.4.2.2 Commercial Recycling Programs 25
2.4.2.3 Recyclable Material Processing and Marketing 26
2.4.2.4 Vehicles and Equipment Used for Recycling Programs 26
2.4.2.5 Solid Waste Management Education and Outreach Services 27
2.4.3 Quantity and Characteristics 27
2.4.4 Recycling System Costs 29
2.4.5 Recycling System Revenue 29
2.4.6 Planned Recycling Program Modifications 30
2.4.7 Development Review/Solid Waste Permitting 31
2.4.8 Enforcement 31
3.0 Recycling Program Evaluation 32
3.1 Recycling Options 32
3.1.1 Option #1: Continued Participation With the Existing County-Provided Recycling Services 32
3.1.1.1 Advantages 32
3.1.1.2 Disadvantages 33
3.1.2 Option #2: Recycling Programs Provided by Contract With a Private Hauler 33
3.1.2.1 Advantages 34
3.1.2.2 Disadvantages 34
3.1.3 Option #3: Town-Operated Recycling Programs 35
3.1.3.1 Advantages 35
3.1.3.2 Disadvantages 35
3.2 Financial Analysis of Town-Operated Recycling Option 36
3.2.1 Curbside Recycling Collection for Single-Family Homes and Duplexes 37
3.2.2 Other Recycling Services 38
3.3 Summary of Comparable Recycling Program Outsourcing Costs 39

3.4 Summary Findings 39
3.5 Conditions for Continued Observation 40
4.0 Solid Waste Collections Evaluation 41
4.1 Observations and Recommendations for Improved Collection Efficiency 41
4.1.1 Residential Collections 41
4.1.1.1 Containers 41
4.1.1.2 Exemptions 42
4.1.1.3 Private Driveways 43
4.1.1.4 Limited Residential Routing Evaluation 43
4.1.1.5 Customer Service System 45
4.1.2 Commercial 45
4.1.2.1 Routing Software 46
4.1.2.2 Collections Route Start Time 46
4.1.2.3 Pickup Days 47
4.1.2.4 Customer Service System 47
4.1.2.5 Reconfiguration of Commercial Collection Services 47
4.1.2.6 Grease Management 48
4.1.3 Yard Waste 48
4.1.3.1 Collaborate With UNC for Yard Waste Processing 49
4.1.3.2 Containers 49
4.1.3.3 Seasonal Loose Leaf Collection 50
4.1.3.4 Knuckleboom 50
4.1.3.5 Re-Education, Notice, and Enforcement of Setout Requirements 50
4.1.4 Bulky Waste Collections 51
4.1.4.1 Operations Improvements 51
4.2 Review of Town Solid Waste Ordinances 52
4.2.1 Article I - General Solid Waste Code 52
4.2.2 Article II - Regulations for Collection and Disposal 52
4.2.2.1 Section 8-21: Definitions 52
4.2.2.2 Section 8-24.1: Brush Disposal 53
4.2.2.3 Section 8-24.3: Limitations on Service 53
4.2.2.4 Commercial Collections 53
4.2.2.5 Section 8-35: Bulk Containers for Multiple Residential Units 53
4.3 Implementing Waste Collection Technologies 53
4.3.1 Transition to Fully-Automated Collections 54
4.3.2 Organics Diversion (Food Waste) 56
4.3.2.1 Summary of Organics Diversion Process 57
4.3.2.2 Estimated Material Volume 57
4.3.2.3 Key Elements of an Organics Diversion Program 58
4.3.2.4 Financial Analysis 62
4.3.2.5 Conclusions and Recommendations 62
4.3.3 Employing Radio Frequency Identification Device Technologies 62
4.3.4 On-Board Scales 63
4.3.5 Solar Powered Trash Compactor Receptacles for Public Areas 63
4.3.6 Monitoring and Locking Devices for Downtown Business Waste Compactors 64
4.4 Conclusions and Recommendations 65
5.0 Solid Waste Collections Program Evaluation of Outsourcing 69

5.1 Decision Factors 69
5.2 Outsourcing: Contract or Franchise? 72
5.2.1 Solid Waste Collections Contract 72
5.2.2 Solid Waste Collections Franchise 73
5.2.3 General and Town-Specific Contract Considerations 73
5.3 Solid Waste Collections Cost Analysis 74
5.4 Solid Waste Collection and Service Fee Comparisons 76
6.0 Disposal Option – Direct Haul to Transfer Station 78
6.1 What Is a Transfer Station? 78
6.2 Identified Target Transfer Stations 79
6.3 Scenario Modeling Analysis 80
6.3.1 Collections Fleet Modifications and Capital Expenditures 82
6.3.1.1 NCDOT Overweight Regulations 82
6.3.1.2 Residential Collection Vehicles 82
6.3.1.3 Commercial Collection Vehicles 83
6.3.1.4 Fleet and Routing Modifications 83
6.3.1.5 Existing Fleet Summary and Projected Replacement Schedule 84
6.3.1.6 Fleet Routing and Modifications 84
6.3.2 Fleet Fuel and Maintenance Costs 85
6.3.3 Impacts to Task-Based Collections System Structure 86
6.3.4 Other Scenario-Consistent Assumptions 87
6.4 Scenario Modeling Results 88
6.4.1 Summary Results 88
6.4.1.1 Results - Six Routes, 3 Days Per Week 88
6.4.1.2 Results – Current Operations with Seven Routes, 2 Days Per Week 90
6.4.2 Net Present Value Evaluation 91
6.4.3 Recommendations 92
6.4.3.1 Solicit a Request for Quotes for Transfer Station Tipping Fee 92
6.4.3.2 Transition to a 3-day Per Week Collection Schedule 92
6.4.3.3 Capital Expenditures 93
6.4.3.4 Additional Collections Staff 93
6.4.3.5 When to Transition? 94
6.5 Other Considerations 94
7.0 Disposal Option – Site/ Construct New Transfer Station 95
7.1 Evaluate Development of a New Town-Only or Regional Transfer Station 95
7.1.1 Transfer Station Siting Challenges, Advantages, and Disadvantages 95
7.1.1.1 Summary of Historical Transfer Station Siting Efforts 95
7.1.1.2 Social Justice and Regulatory Concerns 96
7.1.1.3 Advantages 97
7.1.1.4 Disadvantages 97
7.1.2 Projected 20-Year Disposal Needs 98
7.1.2.1 Population and Disposal Quantity Projections 98
7.1.2.2 Sizing an Appropriate Facility 99
7.1.3 Estimated Transfer Station Development Costs 100
7.1.4 Estimated Transfer Station Operations Costs 102

7.1.5 Summary of Transfer Station Development, Construction, and Operations Costs 105
7.1.6 Identified Target Destination Landfills 105
7.2 Scenario Modeling Results 106
7.2.1 Summary Results 108
7.2.2 Net Present Value Evaluation 108
7.3 Conclusion and Recommendations 111
7.3.1 Recommendations 111
7.3.1.1 Pursue Siting and Permitting a Transfer Station Within the Town 111
7.3.1.2 When to Implement? 112
7.4 Other Considerations 112
8.0 Disposal Option – Pay-As-You-Throw 114
8.1 PAYT Approaches 114
8.1.1 Bag Programs 114
8.1.2 Sticker or Tag Programs 115
8.1.3 Variable Can or Subscribed Can Programs 116
8.1.4 Hybrid Programs 117
8.2 Financial Analysis – PAYT Rates 118
8.2.1 Calculation of Baseline Collection and Disposal Cost 118
8.2.2 Option A – Variable Can Program 119
8.2.3 Option B – Modified Subscribed Can Program 119
8.2.4 Option C – Hybrid Program: Subscribed Can and Bag 119
8.2.5 Financial Modeling Assumptions 120
8.2.5.1 Waste Reduction 120
8.2.5.2 Levels of Service 121
8.2.5.3 Cart Costs 121
8.2.5.4 PAYT Coordinator 121
8.2.5.5 Bag Set Out Levels 122
8.2.5.6 Revenues 122
8.3 Implementation – Lessons Learned 122
8.4 Conclusions and Recommendations 124
9.0 Disposal Option – Site/ Construct a New Material Recovery Facility 126
9.1 Evaluate Development of a New Materials Recovery Facility 126
9.1.1 MRF Siting Challenges, Advantages, and Disadvantages 126
9.1.1.1 Summary Economy of Scale 126
9.1.1.2 Competition from Current Orange County Recycling Program 128
9.1.1.3 Advantages 128
9.1.1.4 Disadvantages 129
9.1.2 Co-Locating MRF or Composting Facility With a New Transfer Station 129
9.1.2.1 Sizing an Appropriate Facility 130
9.1.3 Estimated Development Costs for Co-Located MRF or Composting Facility With a New Transfer Station 131
9.1.4 Estimated Transfer Station/ MRF and Transfer Station/ Compost Facility Operations Costs 133
9.2 Conclusion and Recommendations 136

10.0 Disposal Option – Direct Haul to Out-of-County Landfill 137
10.1 Identified Target Landfill Facilities 137
10.2 Scenario Modeling Analysis 140
10.3 Scenario Modeling Results 141
10.3.1 Results – Current Seven Routes 2 Days Per Week 141
10.3.2 Net Present Value Evaluation 143
10.4 Other Considerations 144
10.4.1 Long-Term Tip Fee and Mileage Analysis 144
10.4.2 Disposal Option Sustainability Analysis 144
10.5 Conclusions and Recommendations 144
11.0 Disposal Option – Site/ Construct a New Landfill 145
11.1 Evaluate Development of a New Town-Only or Regional Landfill 145
11.1.1 Landfill Siting Challenges 145
11.1.1.1 Advantages 146
11.1.1.2 Disadvantages 146
11.1.2 Projected 30-Year Disposal Needs 146
11.1.3 Estimated Landfill Development Costs 149
11.1.4 Estimated Landfill Operations Costs 151
11.1.5 Closure and Post-Closure Care Cost Estimates 152
11.1.6 Summary of Landfill Development, Operations, Closure, and Post-Closure Costs 153
11.1.7 Conclusion and Recommendations 153
12.0 Alternative Technologies – Town of Chapel Hill Benchmark 154
12.1 Reasons to Select a WTE or WC Technology 154
12.2 Classification of Technologies 155
12.3 Conventional WTE Technology 156
12.3.1 Basic Combustion System 156
12.3.1.1 Stages of Combustion 157
12.3.1.2 Waste-to-Energy Solid Waste Combustors 157
12.3.1.3 Products of Combustion 158
12.3.2 Mass Burning 158
12.3.2.1 Process Description 158
12.3.2.2 Operations Experience 160
12.3.3 Modular Combustion 161
12.3.4 Refuse-Derived Fuel Systems 164
12.4 Alternative WC Technologies 166
12.4.1 Thermal 166
12.4.1.1 Pyrolysis - Gasification 166
12.4.1.2 Autoclave 168
12.4.2 Biological 169
12.4.2.1 Anaerobic Process 169
12.4.2.2 Aerobic Process 170
12.4.3 Bio-Chemical 170
12.5 Status of Commercial Operating WTE and WC Facilities 171
12.5.1 Waste-to-Energy 171
12.5.2 Waste Conversion 172

12.5.2.1 Plasma Arc Gasification 172
12.5.2.2 Pyrolysis Plants 172
12.5.2.3 Anaerobic Digesters 173
12.6 Benchmark Metrics 174
12.6.1 Summary of Current Town Solid Waste Statistics 174
12.6.2 Minimum Waste Throughput Processing Capacity 175
12.6.2.1 Waste-to-Energy 175
12.6.2.2 Waste Conversion 175
12.6.3 Summary of Readiness for Commercial Operations 176
12.6.4 Capital and Operating Costs 176
12.6.5 Tipping Fee Survey 178
12.6.6 Comparison to WTE Fees 178
12.6.7 Advantages and Disadvantages 180
12.7 Recommendations to Position the Town for Potential WTE and WC Technologies 181
13.0 Alternative Technologies – Collaboration With Area Institutions 183
13.1 Universities 183
13.1.1 Duke University 183
13.1.2 University of North Carolina at Chapel Hill 184
13.1.2.1 Landfill Gas 184
13.1.2.2 Biomass Feedstock Implementation 184
13.1.2.3 Anaerobic Digestion Potential 185
13.1.3 North Carolina State University 185
13.2 Other Available Area Resources, Projects, and Funding 186
13.2.1 Environmental Research and Education Foundation 186
13.2.2 Southern Research Institute 187
13.2.3 North Carolina Biofuels Center 187
13.2.4 USDA Rural Energy for America Program 188
13.3 Recommendations for Further CollAboration Efforts 188
14.0 Pro Forma Evaluation 190
14.1 Purpose of Pro Forma 190
14.2 Major Components of Pro Forma Model 190
14.3 Program Cost Modules 197
14.4 Pro Forma Results 198

List of Exhibits

No. **Page**

Exhibit 1-1. Pro Forma Model Program Scenarios 4
Exhibit 2-1. Solid Waste Services Division Organization 5
Exhibit 2-2. Waste Disposal Volume Data and Trends 7
Exhibit 2-3. 2010 Waste Composition Study Results 8
Exhibit 2-4. Anticipated Chapel Hill Population 9
Exhibit 2-5. Summary of Area Landfill Tipping Fees 11
Exhibit 2-6. Collection Times 16
Exhibit 2-7. Collection Routes 17
Exhibit 2-8. Average Maintenance and Repair Cost 19
Exhibit 2-9. FY 2012-13 Solid Waste Services Budget 21
Exhibit 2-10. Commercial Sector Bulk Container Collection and Disposal Fees 22
Exhibit 2-11. Vehicles and Equipment for County Recycling Programs 27
Exhibit 2-12. Recycling Material Quantities by Source, FY 2010-11 28
Exhibit 2-13. Recycling Material Quantities by Commodity, FY 2010-11 28
Exhibit 2-14. County Fees for Recycling Applicable to the Town 29
Exhibit 2-15. Current and Expected Costs for Urban Curbside Collection Utilizing Single Stream Recycling 30
Exhibit 3-1. Summary of Capital Costs for a Town-Operated Curbside Recycling Collection Program 38
Exhibit 3-2. Summary of Operating Costs for a Town-Operated Curbside Recycling Collection Program 38
Exhibit 4-1. Number of Residential Units Serviced Per Hour by Collection Method 54
Exhibit 4-2. Advantages and Disadvantages Associated With Semi-Automated and Fully-Automated Collection 55
Exhibit 4-3. Residential Route Potential for Fully-Automated Waste Collection 56
Exhibit 4-4. Organics Diversion Calculation, Town of Chapel Hill 58
Exhibit 4-5. Organics Diversion Collection Estimate for the Town of Chapel Hill 60
Exhibit 4-6. Type III and IV Compost Facilities Within 60 Miles of Chapel Hill, NC 61
Exhibit 4-7. Example of Solar-Powered Trash Compactor 64
Exhibit 4-8. Example of Waste Compactor Security and Monitoring Device 65
Exhibit 5-1. Pro Forma Allocated Budget Costs and Revenues for FY 2012-13 (Status Quo) 75
Exhibit 5-2. Summary of Comparable Solid Waste Programs 77
Exhibit 6-1. Target MSW Transfer Station Facilities 80
Exhibit 6-2. Summary of Target Solid Waste Transfer Stations 81
Exhibit 6-3. Route Capacity Analysis 85
Exhibit 6-4. Projected Town Vehicle O&M Cost 86
Exhibit 6-5. Summary of Direct Hauling to Transfer Station Scenarios (6 Routes, 3 Days Per Week) 89
Exhibit 6-6. Summary of Direct Hauling to Transfer Station Scenarios for Current Residential Route Configurations (7 Routes, 2 Days Per Week) 90
Exhibit 6-7. Net Present Value of Direct Hauling to Transfer Station (6 Routes, 3 Days Per Week) 91
Exhibit 6-8. Net Present Value of Direct Hauling to Transfer Station for Current Residential Route Configurations (7 Routes, 2 Days Per Week) 92
Exhibit 7-1. Population Projections, Town of Chapel Hill 98

Exhibit 7-2. 20-Year Disposal Quantity Projections 99
Exhibit 7-3. Estimated Cost to Develop a Town-Only Transfer Station 101
Exhibit 7-4. Estimated Cost to Develop a Regional Transfer Station for Town of Chapel Hill and Town of Carrboro 102
Exhibit 7-5. Estimated Annual O&M Cost for Town Only Transfer Station Scenario 103
Exhibit 7-6. Estimated Annual O&M Cost for Regional Transfer Station Scenario for Town of Chapel Hill and Town of Carrboro 104
Exhibit 7-7. Summary of Estimated Transfer Station Costs 105
Exhibit 7-8. Summary of New Transfer Station Scenarios 109
Exhibit 7-9. Net Present Value of Town-Only Transfer Station 110
Exhibit 8-1. Advantages and Disadvantages of a PAYT Bag Program 115
Exhibit 8-2. Advantages and Disadvantages of a PAYT Tag/ Sticker Program 116
Exhibit 8-3. Advantages and Disadvantages of PAYT Can Programs 117
Exhibit 8-4. Advantages and Disadvantages of Hybrid PAYT Programs 118
Exhibit 8-5. Collection and Disposal Cost Per Household 119
Exhibit 8-6. PAYT Scenarios 120
Exhibit 9-1. Example Schematic of a Typical MRF Operation 127
Exhibit 9-2. Estimated Cost to Develop a New Transfer Station/ Materials Recovery Facility 132
Exhibit 9-3. Estimated Cost to Develop a New Transfer Station/ Compost Facility 133
Exhibit 9-4. Estimated Annual O&M Cost for New Transfer Station/ Materials Recovery Facility Scenario 134
Exhibit 9-5. Estimated Annual O&M Cost for New Transfer Station/ Compost Facility Scenario 135
Exhibit 10-1. Target Landfill Facilities 138
Exhibit 10-2. Summary of Target Solid Waste Landfill Facilities 139
Exhibit 10-3. Net Present Value Comparison: Transfer Station to Landfill (7 Routes 2 Days Per Week) 143
Exhibit 11-1. Population Projections, Town of Chapel Hill 147
Exhibit 11-2. 30-Year Disposal Quantity Projections 148
Exhibit 11-3. Disposal Capacity and Total Property Area as a Function of Landfill Footprint Area 149
Exhibit 11-4. Summary of Landfill Sizing Requirements 149
Exhibit 11-5. Estimated Cost to Develop a Town-Only Landfill 150
Exhibit 11-6. Estimated Cost to Develop a Regional Landfill 150
Exhibit 11-7. Estimated Annual O&M Cost for Town Only Landfill Scenario 151
Exhibit 11-8. Estimated Annual O&M Cost for Regional Landfill Scenario 152
Exhibit 11-9. Summary of Estimated Landfill Costs 153
Exhibit 12-1. Cross-Section of Typical Mass-Fired Waterwall Facility 159
Exhibit 12-2. Cross-Section of Typical Modular Facility 161
Exhibit 12-3. Cross-Section of Batch Oxidation System, Modular Facility 162
Exhibit 12-4. Comparison of Active Modular Combustion Facilities 163
Exhibit 12-5. Cross-Section of Typical RDF System 165
Exhibit 12-6. Basic Gasification Process 167
Exhibit 12-7. Basic Plasma Gasification Process 168
Exhibit 12-8. Basic Autoclave Process 169
Exhibit 12-9. Basic Anaerobic Process 170
Exhibit 12-10. Basic Bio-Chemical Process 171
Exhibit 12-11. U.S. WTE Plants by Technology 172
Exhibit 12-12. Commercial Operating Plasma Arc Gasification Facilities 172

Exhibit 12-13. Commercial Operating Pyrolysis Facilities Using MSW 173
Exhibit 12-14. European Countries With AD Facilities 174
Exhibit 12-15. Summary of Main Processes 176
Exhibit 12-16. Summary of Project Economics for Thermal and Biological Conversion Technologies(1) 177
Exhibit 12-17. Summary of Economic Data(1) 178
Exhibit 12-18. Summary of Tipping Fee Range for Technologies 179
Exhibit 12-19. Advantages and Disadvantages to Waste Processing Technologies 181
Exhibit 13-1. Collaboration Contact Summary 189
Exhibit 14-1. Solid Waste Projections, Town of Chapel Hill Status Quo Scenario, FY 2012 - 2022 192
Exhibit 14-2. Solid Waste Projections, Town of Chapel Hill Implement PAYT Program, FY 2012 - 2022 193
Exhibit 14-3. Solid Waste Projections, Town of Chapel Hill Implement Organics Diversion and PAYT Program, FY 2012 - 2022 194
Exhibit 14-4. Pro Forma Budget Summary for FY 2012-13 195
Exhibit 14-5. Example Program Scenarios and Decision Inputs 199
Exhibit 14-6. Example Pro Forma Output FY 2013 - 2022 200
Exhibit 14-7. Example Output Summary From Pro Forma Model, Net Present Value of Program Scenario 3-day Per Week and 2-day Per Week Pickup Schedules 201

Appendices

A Commercial Collections Evaluation
B Evaluation of Multi-Family Waste Collection and Disposal Service Levels

List of Acronyms

CDD	Construction and Demolition Debris
CHP	Combined Heat and Power
cy or CY	Cubic Yard
DCOI	Duke Carbon Offset Initiative
Duke	Duke University
FY	Fiscal Year
LFG	Landfill Gas
kWh	kilowatt-hour
MMBTU	Million British Thermal Units
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
NCDENR	North Carolina Department of Environment and Natural Resources
NCSU	North Carolina State University
OCR	Orange County Recycling
O&M	Operations and Maintenance
PAYT	Pay-As-You-Throw
RFID	Radio Frequency Identification Device
REC	Renewable Energy Credits
REPS	Renewable Energy Portfolio Standard
RFP	Request for Proposal
SWAB	Solid Waste Advisory Board
SWSD	Solid Waste Services Division
US EPA	United States Environmental Protection Agency
UNC	University of North Carolina at Chapel Hill
WTE	Waste-to-Energy
WC	Waste Conversion

EXECUTIVE SUMMARY

INTRODUCTION

The Town of Chapel Hill (Town) contracted SCS Engineers (SCS) to provide professional engineering services for this Comprehensive Review of Solid Waste Collection and Disposal Options (Study). The purpose of the Study is to examine the Town's current solid waste collections and disposal programs to identify opportunities to enhance these services, improve efficiencies, and evaluate the applicability of innovative technological developments in the solid waste industry, including: recycling, re-use, waste conversion, and waste-to-energy (WTE). The results of this evaluation will be used by Town Council, Solid Waste Services Division (SWSD) staff and other Town staff to guide decision making when considering current and future solid waste management issues. This study also reviews opportunities for collaborative partnership to assist in enhancing the solid waste management system. Lastly, when evaluating identified options, the Study considers the Town's organizational values, and commitment to sustainability through social equity, economic vitality and environmental stewardship.

SCS evaluated a series of issues and alternatives relative to the Town's solid waste collection, disposal, and recycling functions. The major findings, conclusions, and recommendations resulting from these evaluations are summarized in this executive summary. Background information on the Town's demographics, solid waste generation, current solid waste system and budget, and operational practices is provided within the body of the report, and is not repeated in this section.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

- **Recycling Program.** SCS recommends that the Town continue to participate with Orange County to provide recycling services to its residents and businesses in lieu of creating its own program or independently contracting with a new third party for all or part of the recycling services. Initiating a new Inter-Local Agreement with Orange County that identifies metrics of success and governance for the recycling program is recommended. SCS did not identify significant cost savings or improved operational efficiencies resulting from the alternatives considered. Furthermore, ongoing participation with Orange County's program promotes continued regional cooperation and the economies of scale that result. One of the recommendations provided for the Town's solid waste collection program involves conducting a routing and technology study to optimize the collection routes. Coordinating the residential and recycling collection days may be desirable, and could be addressed in the routing study; however, since the County manages the curbside recycling program, the Town does not have a direct say regarding the scheduling of the recycling pickup days.

- **Residential Solid Waste Collections.** SCS recommends the Town consider the following recommendations regarding its residential solid waste collection program:

  - **Routing and Technology Study.** Conduct a formal, residential and commercial routing and technology study to optimize the Town's residential curbside

collection program taking into account potential changes in equipment, personnel, and collection methodology (e.g., automation and vehicle capacity), and collection schedule. A routing and technology study would likely take four to six months to complete. A budget of $50,000 to $70,000 is estimated to complete a routing and technology study. If the routing study was contracted by January 2013, it could be completed by mid-2013. Full implementation of any recommended changes likely could be implemented by mid-2014.

- **Collection Routes.** Approve a budget amendment to fund the current collection routing configuration, which includes seven residential curbside collection routes running two days per week, until the routing and technology study described above can be conducted to confirm the most optimum routing and scheduling configuration. The Town's budget currently includes funding for only six routes, although seven routes are currently being dispatched using temporary employees. SCS evaluated changes that would be needed to the collection schedule to accommodate the currently budgeted six route configuration and concluded that an additional collection day would be needed for residential curbside collection and the routes would need to be reconfigured. Reconfiguring the collection network to six routes and a three-day per week collection frequency appears feasible and could result in potential cost savings compared to fielding seven routes. If the Town were to keep the six route configuration, it would need to reconfigure work schedules (e.g., from the current 4-day, 10-hour per day workweek to a 5-day, 8-hour per day workweek) and reconfigure the collection routes. The routing and technology study recommended above is needed to confirm the feasibility and practicality of these changes and could potentially identify additional alternative routing configurations, staffing, equipment deployment, and collection day schedules.

- **Automation.** Implement a partial transition to fully-automated residential waste collection for a select route or routes in a pilot phase study planned for FY 2014-15, depending on the results of the routing and technology study. This would require the purchase of at least one (and likely two) new automated collection truck(s). SCS recommends the Town consider a 28-cubic yard capacity fully automated collection vehicle. This type of vehicle costs approximately $250,000, compared to the Town's current 18 to 20-cubic yard semi-automated rear loading vehicles, which have a budgeted replacement value of $139,000.[1] Following this pilot study, SCS believes the Town could transition most of the existing routes to full automation within 2 to 4 years with the replacement of collections fleet vehicles in accordance with the current depreciation and vehicle schedule. Cost savings are projected over the 30-year period considered in this study if the Town were to transition to automated collection primarily due to decreased labor costs. Depending on how the routes are configured and staffed (six routes versus seven

[1] Another option, not specifically addressed in this study, is the use of compressed natural gas (CNG) vehicles. CNG fuel on a diesel equivalent basis costs significantly less than diesel fuel, and CNG vehicles are quieter, and have fewer emissions. However, CNG vehicles are more expensive (e.g., +$40,000 per vehicle), require special maintenance facilities, have additional maintenance requirements and costs, and require a dedicated special filling station or access to such station.

routes, or some other configuration), and when and how automation is phased in, SCS estimated savings of between $7 to $14 million over a 30-year period. The routing and technology study recommended above will provide additional guidance with respect to the deployment and number of automated routes.

- **Vehicle Replacement.** Replace the oldest 18 or 20 cubic yard tandem-axle rear-loading compactor truck with a new, 18 or 20 cubic yard collection vehicle in accordance with the Town's programmed capital expenditures for FY 2012-13. The existing collection vehicle can then be designated as a backup vehicle to replace one of the single-axle vehicles. The Town should also consider replacing the existing single-axle backup vehicles with tandem-axle vehicles (the Town currently has four of these) in order to have sufficient backup vehicles. This is especially critical as the Town transitions to an alternative disposal facility by July 1, 2013. Replacing the four existing backup vehicles is estimated to cost $760,000, which is subject to various arrangements and upgrade options. This recommendation is independent of the collection routing and technology decisions.

- **Collection Carts.** Require that residential MSW be placed in a Town-issued waste collection cart, unless special collection for bulky waste and/or excess waste is arranged in advance, on a per incident basis, with collections staff. SCS suggests the Town provide one cart per household at no charge and, if requested by residents, supply additional carts for an annual fee. Implementation will likely require 6 months to a year and public notification along with a public education campaign will be necessary.

- **Pay-As-You-Throw (PAYT).** Develop a collections infrastructure to collect excess residential waste that does not fit into the Town-issued waste collection cart via a hybrid PAYT program (i.e., sticker or bag). Implementing such a modified PAYT program would introduce the concept to Town residents while holding excess waste generators accountable for incremental collections costs. Implementing a PAYT program can be instrumental in reducing the quantities of municipal solid waste that must be disposed through increased recycling, composting, and changes in behavior that reduce the amount of household waste generated. Research suggests that municipal solid waste disposal tonnages can be decreased by 16 to 17% with the implementation of PAYT programs. The major additional costs include the hiring or assigning a PAYT coordinator (assumed $45,000 per year, or 50% of a full-time staff person's time), and purchase of carts and applicable stickers (the details of the carts and use of stickers will need to be finalized with the full development of the program. Stickers are sometimes used in conjunction with carts and bags to facilitate identification and approval of containers). SCS estimates that an additional 2,100 carts would need to be purchased at an average cost of $50/cart (mix of 32-gallon and 96-gallon carts) to accommodate lower and higher generators, for a capital cost of $106,000. A detailed discussion of the variables considered, potential fee structures, and a phased in approach is provided in Section 8.0.

- **Curbside Collection Exemptions**. Limit residential special collection (exemptions and private driveway service) to those who have mobility challenges and charge an additional fee for special collections requested by residents with challenging private driveway access. The Town should review and audit all the special exemptions (existing and future).

- **Customer Service Technology.** Consider investing in a customer service system, such as Mobile 311, for residential, commercial, yard waste, and bulky collection services. The cost for Mobile 311 is $60 per month per field user excluding the purchase cost of a smartphone and monthly mobile phone contract. SCS estimates a total monthly cost of approximately $2,700, assuming $100 per month for each mobile phone contract, based on 17 users under the current residential and commercial collection configuration. There is a one-time services setup fee of $500 and training is available for $125/hour. There may be some additional administrative and program costs for such a program, which is beyond the scope of this study, but it is believed to be negligible compared to the monthly operational costs. If the Town wishes to add additional users, the price costs would adjust accordingly.

- **Yard Waste Collection.** Require yard waste be placed in Town-issued, yard waste carts for collection and require that residents schedule and pay for collection of large piles of yard waste (too large for the one cart) or additional carts. SCS suggests the Town provide one cart per household at no charge and, if requested by residents, supply additional carts for an annual fee. Implementing this change would likely require 6 months to a year to implement, and require public education and notification.

- **Enhanced Billing and Payment Collection System.** The Town needs to evaluate options for an enhanced billing and payment collection system to accommodate billing and recovery activities associated with the MSW and yard waste carts, yard waste piles, private driveway service, PAYT program, etc.

- **Commercial Solid Waste Collections.** SCS recommends the Town consider the following recommendations regarding its commercial solid waste collection program:

  - Given the declining number of commercial accounts and reduction in tonnage, consider reducing the number of days per week used for commercial waste collection. A formal routing analysis and maximizing container capacities may result in further routing consolidation, supporting a collection schedule change. By consolidating collection days, the waste containers would maximize their volume capacity, collection vehicles may more efficiently achieve load capacity along fewer trips to these customers, and the Town would recognize a savings in fuel and equipment usage charges attributed to this extra collection day. However, when consolidating collection days and maximizing container capacities, these analyses must take into consideration the need for contingent waste capacity needed to manage excess volume in the event Town collection vehicles break down, or during peak disposal periods coinciding with the school

calendar. The routing and technology study recommended above would address optimization of the commercial collection routes.

- Consider allowing commercial waste collection crews to begin waste collection as early as 4:30 a.m. to facilitate completing collection prior to heavy traffic times in commercial areas.

- Consider the purchase and use of solar-powered trash compactors dispatched to public areas for use by the general public (e.g., street cans). These units can hold about five times the amount of a normal trash receptacle, thus reducing the servicing frequency of the containers. However, the units are relatively expensive ($3,700). The design of the units would also need to be reviewed by the Town's Planning Department to assure consistency with streetscape architectural standards.

- Consider changes in the management of the two commercial compactors owned and operated by the Town in the commercial district. The Town should consider changing the locks for the waste compactors and reassessing users of the waste compactors to confirm that all users are being properly charged. The new inventory and registration process should include education through brochures or a flyer about the operation of the waste compactors as is the current practice. Additionally, the Town should install signage in both English and Spanish on the operation of the waste compactors. The Town should also consider using technology that limits usage, records frequency of compactor usage by businesses, and offers data retrieval for billings. These types of systems store information on usage by businesses that can be downloaded periodically by the Town.

- **Outsourcing.** SCS does not recommend the Town pursue outsourcing its residential collection program at this time. Outsourcing of collection services is a feasible alternative, and used by Communities throughout North Carolina and elsewhere; however, SCS did not identify significant operational, cost, or service benefits that would result to the Town through outsourcing the collection services. The collection services the Town currently provides are similar to other communities and the cost of service is within expected cost ranges. Self-performing these services provides the Town maximum flexibility to respond to the needs of the community. The Town currently provides a high level of service to its citizens through its residential curbside, yard waste, bulky waste, and commercial collection programs, as well as the various special provisions it makes to handle special collection situations. Outsourcing this function would likely result in diminished levels of services due to the nature of contracted services (i.e., contractors do what the contract says and ask for change orders for variations).

- **Disposal Options.** SCS's evaluation and analysis of identified disposal options resulted in both short term and long term recommendations for the solid waste program as follows:

- **White Goods.** SCS recommends that the Town continue collecting and delivering white goods to the Orange County Landfill facility for recycling.

- **Short-Term, Transfer and Disposal of Municipal Solid Waste.** SCS recommends that the Town direct haul residential and commercial waste to an out-of-county solid waste disposal facility, beginning no later than July 1, 2013, selected through the Town's procurement process (i.e., a solicitation of quotes). During our analysis, SCS identified two transfer stations located approximately 17 to 18 miles from the Town of Chapel Hill: the City of Durham Transfer Station[2], and the Waste Industries Transfer Station (also in Durham). This short-term solution provides the quality of service the Town's residents value, while the SWSD and Town Council continue to evaluate future solid waste disposal options.

  SCS concluded this approach was the preferred short-term option for the Town for cost and operational reasons, since it is unlikely that the Town could site, permit, and construct its own transfer station facility before July 1, 2013, and doing so would increase its solid waste management costs compared to the projected direct haul option costs. Based on financial modeling, the Durham locations appear to present the lowest cost of the viable options. If current operations are maintained, SCS estimates an additional $368,300 would be needed to implement this option due to increased labor, equipment, fuel, and maintenance costs. This analysis assumed a $42.50/ton tip fee. If the Town selects the Waste Industries bid, these costs figures would reduce by approximately $25,000 per year.

- **Short-Term, Transfer and Disposal of Yard Waste.** SCS recommends that the Town continue collecting and delivering yard waste to the Orange County yard waste facility, where the County provides mulching and composting operations. This recommendation is made for the following reasons: 1) the operation is proven and reliable and makes beneficial use of the yard waste collected; and, 2) the Orange County fees are reasonable for the service provided. However, the Town should continue to consider potential partnership with the University of North Carolina and its yard waste and organics management programs. The University has expressed an interest in exploring a partnership with the Town to manage yard waste.

- **Long-Term, New Transfer Station.** SCS recommends the Town pursue development of its own transfer station in conjunction with evaluating the operational and fiscal performance of the direct haul scenario to Durham. SCS recommends that the Town continue to evaluate developing a transfer station in

[2] During our analysis, SCS engaged in preliminary discussions with the City of Durham solid waste staff. They confirmed they would be interested in accepting the Town's projected waste volume; however, the advertised tip fee ($42.50) is reportedly not negotiable. The City of Durham would entertain establishing a long-term agreement with the Town to fix this rate for an extended period of time. Also just prior to completing this report, the Town received quotes from the City of Durham and Waste Industries for disposal at their transfer stations for $42.50 /ton and $41.00/ton, respectively. The Town may elect to begin transitioning to the new disposal location prior to July 1, 2013 in order to work out logistical issues.

the future for the following reasons: 1) a Town-operated transfer station provides maximum flexibility on where the Town disposes its waste and at what cost; 2) a Town-operated transfer station would promote self-reliance and independence from the decisions of other entities; and, 3) a Town-operated transfer station provides for additional flexibility in handling various waste streams and recyclables in the future. Development, construction, and equipment cost estimates for both a Town-only and Regional facility considered in this study ranged from $2.6 to $3.2 million, with annual operating expenses ranging from $342,000 to $472,000, respectively. Developing a new transfer station would include the following major tasks: a) conducting a siting study; b) potential property acquisition and zoning approvals); c) design and permitting; d) bidding; and, e) construction.

- **Long-Term, New Transfer Station/Material Recovery Facility (MRF).** SCS recommends that the Town not engage in development of a stand-alone MRF at this time for the following reasons: 1) Siting and developing a new stand-alone MRF is not considered to be a productive or an economically viable operation due to prohibitive costs arising from insufficient material quantities (yielding infeasible economies of scale); and, 2) it would have a negative impact on the current regional cooperative recycling strategy with Orange County. However, in the event the Town pursues development of its own transfer station, SCS recommends the Town consider potential adaptation of the facility to include additional equipment and capabilities to enable recovery and processing of yard waste, recyclables and possibly organic wastes. The concept of a co-located MRF and/or vegetative waste composting facility in conjunction with a transfer station could be further refined in conjunction with future siting and design efforts, as appropriate.

- **Long-Term, Organics Diversion.** SCS does not recommend the Town pursue a separate organics collection program at this time; however, the Town should continue to evaluate this conclusion in light of future technology and regulatory changes (e.g., bans on disposal of food waste in landfills). Implementing a Town-managed residential and/or commercial organics collection and diversion program likely would add significant additional expenses to the Town's solid waste budget.

- **Long-Term, Waste to Energy and Other Waste Conversion Technologies.** Many of the WTE and waste conversion technologies considered in this study appear to be cost prohibitive with the Town's current and projected quantities of municipal solid waste. Mass burn or refuse derived fuel WTE facilities are proven at the commercial scale; however, they generally require larger waste flows and other economic conditions to be feasible. In addition, the other alternative waste conversion technologies currently under consideration by some municipalities throughout the United States, such as plasma arc, gasification, and anaerobic digestion, have not been proven at a commercial scale with municipal solid waste, and the reported capital, operational and maintenance costs for these technologies vary widely. SCS's opinion is that regional efforts will be necessary to secure the

desired waste flow to provide economies of scale for these technologies. Consequently, we recommend that the Town implement a "wait and see approach" relative to moving forward with any WTE or waste conversion technologies. The Town should continue to pursue potential synergies between innovative technology vendors, local institutions of higher education, and professional associations to attract interest in fostering further feasibility studies and/or development of pilot studies.

- **Sit/Construct a New Landfill.** SCS does not recommend the Town proceed with developing its own landfill, but continue to participate in potential future regional cooperative efforts in this regard for the following reasons: 1) siting, designing, permitting, and constructing a new landfill within the Town limits would be difficult and would require significant capital investment and political determination over a long-period, since implementing such a strategy could take as much as a decade to complete; and, 2) insufficient economies of scale (e.g., dollar per ton costs would be significantly higher than other alternatives for a Town-only landfill). However, SCS concluded that a new regional landfill could be developed and provide disposal capacity at a tip fee similar to what the Town currently is paying Orange County.

QUALITATIVE COMPARISON OF PROGRAM SCENARIOS EVALUATED

SCS considered both quantitative and qualitative factors in the evaluation of the collection, transfer, processing, and disposal scenarios included in this study. The evaluation took into account the Town's Comprehensive Plan and goals set forth in the 2020 Vision process with respect to social, fiscal, and environmental impacts, including the following:

- Social Impact
  - Quality of Service
  - Convenience to Customers
  - Roadway Safety
  - Cleanliness/Odor
  - Social Justice
  - Community Pride and Responsibility
- Fiscal Impact
  - Cost of Service
  - Cost to Town Government
  - Cost to Commercial Customer
  - Cost to Residential Customer
  - Government Control of Costs
  - Job Loss/Creation
  - Municipal Bond/Capital Generation

- Environmental Impact

  - Fuel Cost
  - Fuel Consumption
  - GHG Emissions
  - Waste Reduction Goals
  - Groundwater
  - Air
  - Stormwater
  - Permitting

The report addresses these factors in more detail, and discusses the advantages and disadvantages of the alternatives and the interplay of social, fiscal, and environmental factors in the recommendation and decision making process.

IMPLEMENTATION SCHEDULE

The implementation schedule for individual initiatives is presented in the individual sections of this report and is intended to provide a preliminary timeline for the implementation of the recommendations contained in this report. This study includes an assessment of a variety of issues relating to the Town's current and future solid waste management system, including recycling, residential and commercial collection, yard waste management, and short and long-term solid waste processing and disposal options. The preliminary timeframes are dependent on a number of factors involving decisions by the Town Council regarding strategic matters (e.g., decision on a new transfer station, decision to proceed with automation or other program changes such as collection day schedules), public involvement and notification, procurement, inter-department coordination, and approvals by the Town Council and State and local agencies. As such, the timeframes for the individual tasks may vary.

1.0 INTRODUCTION

1.1 PROJECT PURPOSE

The Town of Chapel Hill (the Town) contracted SCS Engineers, PC (SCS) to provide professional engineering services for this Comprehensive Review of Solid Waste Collection and Disposal Options (the Study). The purpose of the Study is to examine the Town's current solid waste collections and disposal programs to identify opportunities to enhance these services, improve efficiencies, and evaluate the applicability of innovative technological developments in the solid waste industry, including: recycling, re-use, waste conversion, and waste-to-energy (WTE). The results of this evaluation will be used by Town Council, Solid Waste Services Division (SWSD) staff and other Town staff to guide decision making when considering current and future solid waste management issues.

1.2 TOWN GOALS

The primary goal of the Study is to complete a comprehensive review of all areas of the Town's SWSD program to include:

- Solid Waste Disposal
    - Both Residential and Commercial Municipal Solid Waste (MSW)
    - White Goods and Bulky Wastes
    - Yard Waste and Brush
    - Food Waste, Oils, and Grease
- Solid Waste Collections and Transportation
- Recycling and Re-Use
- Opportunities for Waste Conversion and/or Waste-to-Energy Technologies

Furthermore, with this study the Town hopes to identify and evaluate opportunities for public-private partnership, where appropriate, to assist in enhancing the solid waste management system. Lastly, when evaluating identified options, the Study considers the Town's organizational values, and commitment to sustainability, social equity, economic vitality and environmental stewardship.

1.3 TOWN GOVERNANCE

The Town is governed by a Town Council and Mayor who decide policies, directives, and a budget in the best interest of the Town and its citizens. This elected body consists of eight (8) council members and the Mayor. Council members serve a 4-year term and are elected on a rotating 2 year schedule, designed to facilitate transition and maintain continuity. Similarly the Mayor serves a 2-year term. Elected council members serve the Town in a non-partisan, at-large capacity and do not represent any identified districts.

Town Council appoints the Town Manager to carry out the directives decided by council. The Public Works Director oversees the SWSD, among numerous other divisions, and reports to the Town Manager. The results of this study will be presented to the Town Manager by the Public Works Director, with recommendations carried to Town Council by the Manager for consideration and deliberation. Decisions concerning programmatic and budgetary changes to the current solid waste services program will be made by a majority of Town Council.

Compared to other localities, matters of Town governance and the budgetary process are open door practices with an engaged citizenry. Core government functions include regularly scheduled bi-weekly Town Council meetings, board and commission meetings, public forums, and Board work sessions open to the public. Much information is available publically posted to the Town website and include: previous and future proposed budgets, annual financial reports, meeting minutes and video, presentations, and comprehensive plans.

The Town's annual budget is routinely presented and adopted in June by the Town Council. Thereafter, Council enters a recess until September. The timing and presentation of much of this study information is understandably critical to the Town's budgetary and governance cycle.

1.4 BACKGROUND INFORMATION

Currently, the Town provides solid waste collection services for residential and commercial customers. The solid waste collected by the Town is disposed at the Orange County Landfill (Landfill) located on Eubanks Road in Chapel Hill. The Landfill commenced operations in 1972 by the Town and since 1999 has been owned and operated by Orange County as the regional solid waste management and disposal facility for the County and surrounding municipalities of Chapel Hill, Carrboro, and Hillsborough.

The Landfill consists of an active MSW landfill unit (Solid Waste Permit No. 68-01) and an active construction and demolition debris (CDD) landfill unit (Solid Waste Permit No. 68-04). While the MSW landfill unit is nearing its permitted capacity, and in keeping with organizational values and socio-political considerations, the County decided to cease acceptance and disposal of MSW and formally close the MSW landfill unit beginning July 1, 2013. Other operations now conducted at the Landfill facility are projected to continue including construction and demolition waste burial, yard waste and clean wood waste mulching, collection and transfer of tires, white goods, scrap metal, and conventional recyclables processing and transfer.

The pending closure of the MSW landfill unit at the Landfill will necessitates that the Town implement alternate arrangements for disposal of this segment of the solid waste stream.

By commissioning this Study the Town recognizes the closure of the MSW landfill unit will mandate a change in solid waste management practices and is seizing an opportunity to review and re-define their future solid waste management program to include systematic operational efficiencies and innovative technological advancements in the solid waste industry for the short-term and long-term benefit of its citizens.

1.5 COLLECTION AND DISPOSAL OPTIONS INTRODUCTION

Solid waste collection and disposal practices and options evaluated by this Study include:

- Summary of current collection and disposal practices and costs;
- Implementing a Town-operated recycling program;
- Identifying opportunities for improvement in collection system efficiencies;
  - Collections routing and scheduling
  - Semi-automated and Automated collection
  - Equipment and technologies
- Collection system outsourcing;
- Direct transportation and disposal to an out-of-county transfer station;
- Siting and constructing a transfer station;
- Implementing Pay-As-You-Throw (PAYT) policies;
- Siting and constructing a material recovery facility (MRF);
- Direct transportation and disposal to an out-of-county landfill;
- Siting and constructing a new municipal solid waste (MSW) landfill;
- Considering the feasibility of relevant waste-to-energy (WTE) and waste conversion technologies; and,
- Collaborating with area universities to advance alternative disposal technologies.

1.6 SCENARIO MODELING INTRODUCTION

For economic analysis, SCS developed a Pro Forma Model specifically for this Study to provide preliminary, planning-level cost estimates and revenue projections to compare the alternative collection, disposal, recycling, and other solid waste program scenarios considered for the Town during the course of this Study. A 30-year planning period was selected to estimate the net present values of the alternative scenarios considered. Section 14 provides a detailed description of the pro forma model methodology, structures, assumptions, and results.

The Pro Forma Model is a spreadsheet program that projects annual costs to construct, operate, administer, and maintain the Town's existing and hypothetical future solid waste collection, processing, recycling, and disposal infrastructure. The model uses decision tree-type logic to modify waste projections, collection and disposal costs and revenue estimates, select disposal location (e.g., direct haul to an existing transfer station, construct a new transfer station, or direct

haul to a new or existing landfill), and schedule when certain program modifications are implemented. The model addresses major capital and an operational cost to operate the Town's solid waste system under various assumptions and configurations as described in more detail below.

The model is fairly complex. For each scenario, consistent assumptions are made regarding annual solid waste quantities, population projections, escalation rates for waste growth and costs, administration costs, transportation costs, and landfill, waste-to-energy, and conversion technology processing and disposal costs. The output from the model is an estimate of the net present value (NPV) of each alternative strategy or scenario. NPV costs are calculated for each alternative scenario for the 30-year planning period to allow for comparison of the scenarios from a cost perspective. NPV is the current value of one or more future cash payments and offsetting revenues discounted at an assumed interest rate. A NPV analysis is a useful tool in evaluating alternatives involving complex cash flows. For this analysis, a lower NPV represents a more favorable scenario from an overall cost perspective only.

The program scenarios evaluated using the pro forma model are presented below in Exhibit 1-1.

Exhibit 1-1. Pro Forma Model Program Scenarios

Designator	Description
A	Status Quo, No New Programs, No Automation of Residential Collections, Town Keeps Commercial Collections
B	No New Programs, Town Eliminates Commercial-Business Collections, Town Keeps Multi-Family Collections
C	No New Programs, Town Eliminates All Commercial Collections
D	Automate Residential Collections, Town Keeps Commercial Collections
E	Automate Residential Collections, Implement PAYT Program, Town Keeps Commercial Collections
F	Automate Residential Collections, No PAYT, Town Implement Organics Diversion Program, Town Keeps Commercial Collections
G	Automate Residential Collections, Implement PAYT, Town Implement Organics Diversion Program, Town Keeps Commercial Collections
H	Develop New Regional Landfill, Automate Residential Collections, Town Keeps Commercial Collections, No PAYT, No Organics Diversion
I	New Regional Landfill, Automate Residential Collections, Town Keeps Commercial Collections, PAYT, Organics Diversion

2.0 SUMMARY OF CURRENT SOLID WASTE MANAGEMENT SYSTEMS

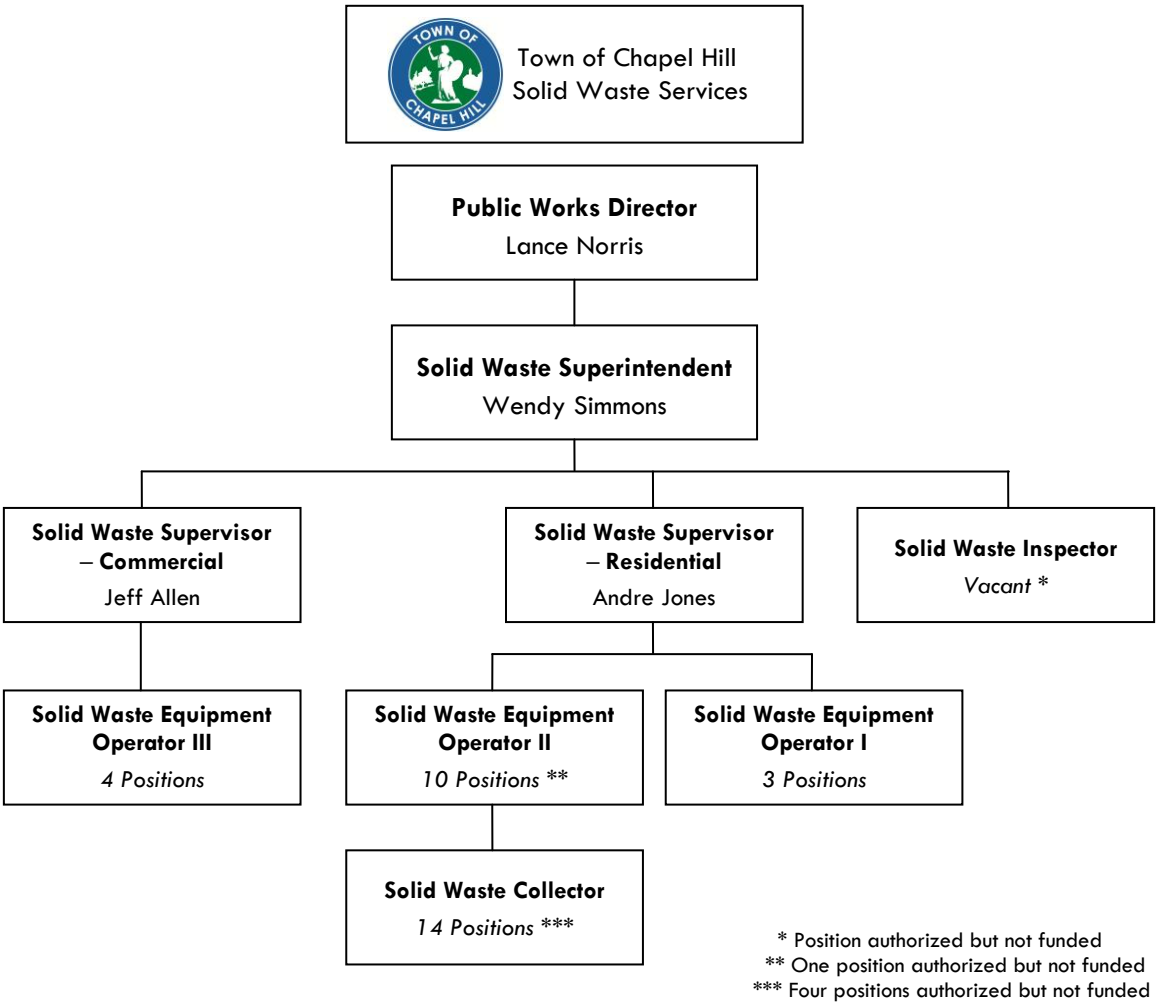
2.1 SOLID WASTE DISPOSAL

2.1.1 Current Disposal System Structure

2.1.1.1 Town of Chapel Hill

Solid waste collection and disposal for the Town is managed by Solid Waste Services, a division of the Public Works Department. The organizational structure of the SWSD is depicted in Exhibit 2-1 and includes 35 positions. The SWSD is managed by a Superintendent and is divided into Commercial operations and Residential operations, each with a designated Supervisor. The SWSD includes seventeen (17) equipment operators and fourteen (14) waste collectors. The roles and responsibilities of these subordinate positions are further described in Section 2.2.4.

Exhibit 2-1. Solid Waste Services Division Organization



The Public Works Director presides over the following Town divisions: Engineering and Design Services, Facilities Management, Inspections, Streets and Construction Services, Traffic Engineering, Stormwater, Administrative and Support Services, Fleet Services, and Solid Waste Services. SWSD is managed by a Superintendent with three (3) direct reports: a Residential Collections Supervisor, a Commercial Collections Supervisor, and a Solid Waste Inspector. The Solid Waste Services Superintendent and Public Works Director have authority to manage the solid waste program within the constraints of the municipal ordinances promulgated by the Town and the program's current objectives, policies, design and established annual budget. Decisions impacting the program objectives, policies, system design, services, and budget are determined by Town Council, memorialized in municipal ordinances as appropriate, and implemented by the Director and Superintendent as directed by the Town Manager.

2.1.1.2 Solid Waste Advisory Board

In 1999 when Orange County assumed ownership and operation of the Orange County Landfill, the three (3) area municipalities (Chapel Hill, Carrboro, and Hillsborough) and Orange County entered into an Interlocal Agreement regionally committing to dispose of collected solid waste at the Orange County Landfill. With the closure of the MSW landfill unit, the municipalities may or may not decide to amend the existing Interlocal Agreement or enter into a new Interlocal Agreement to guide ongoing regional collaboration.

In 2000, through the Interlocal Agreement, the members created the Solid Waste Advisory Board (SWAB). SWAB was formed to advise the County and participating municipalities on solid waste issues, budgeting, policy, and other related matters. SWAB was designed to be comprised of eight (8) members, two (2) members from each participating entity, and two (2) liaisons, one (1) each for the Board of County Commissioners, and the University of North Carolina at Chapel Hill (UNC). The two (2) members representing the Town are appointed by the Town Council and serve a 3-year term. The potential for SWAB activities continuing forward after closure of the MSW landfill unit at the Orange County Landfill and potential expiration of the Interlocal Agreement is yet to be determined; however, the Town agrees SWAB may promote beneficial discussions regarding ongoing collaboration regarding regional solid waste issues.

2.1.1.3 Other Department Assistance

In addition to Solid Waste Services, several other Town divisions routinely assist in solid waste management issues. These include: Engineering and Design Services/Special Projects; the Sustainability Office; and Economic Development Office. These other divisions provided key input when evaluating capital improvements to the Town's solid waste collections and management (i.e., recycling programs, composting and mulching, siting a transfer station, implementing a MRF, evaluating WTE and waste conversion technologies).

2.1.2 Solid Waste Disposal Quantity

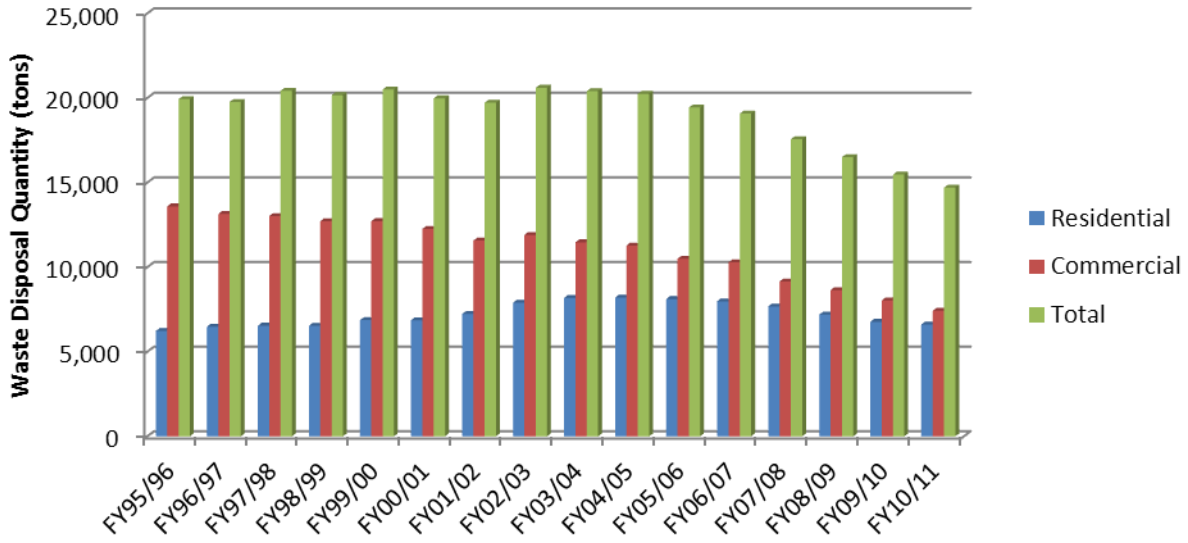
According to the most recent "Solid Waste and Materials Management Annual Report" for the period July 1, 2010 through June 30, 2011, submitted to the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Waste Management, the Town collected and disposed of 14,700 tons of MSW at the Orange County Landfill. According to

Orange County records, the Town's disposal quantities have historically represented approximately 25 to 30% of total MSW accepted at the Landfill. Of the total MSW disposed by the Town in 2010-2011, approximately 6,715 tons (45%) were attributed to residential collections, with the balance attributed to bulky waste and commercial collections. In addition, the Town reported 2,470 tons of yard waste were transported and delivered to the Orange County Landfill for management via grinding and mulching. Total MSW and yard waste collected by the Town and delivered to the Landfill in 2010-2011 equals 17,170 tons.

SCS reviewed waste disposal records dating to 1995/96 and noted the following trends:

- Historical total waste disposal quantities remained relatively consistent through 2007, averaging approximately 20,000 tons annually.
- Since 2007, total waste disposal quantities have decreased, declining more than 25% over the last 5 years. This decrease is primarily associated with a reduction in commercial waste.
- The commercial waste contribution to total waste disposal has decreased from 68% in 1995 to 55% in 2011. During this same period, the residential waste contribution to total waste disposal has remained relatively consistent, averaging approximately 7,000 tons, and its contribution to total waste disposal has increased from 31 to 45% in 2011. Exhibit 2-2 depicts these data and trends in historical waste disposal quantities.

Exhibit 2-2. Waste Disposal Volume Data and Trends

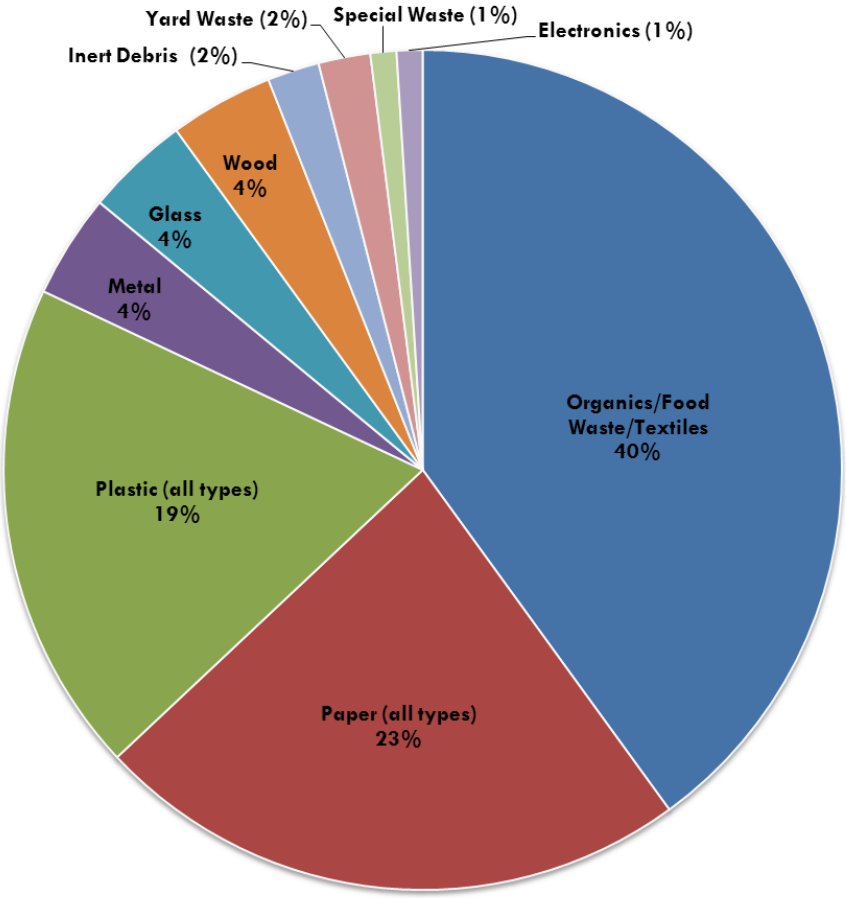


2.1.3 Solid Waste Characterization

SCS has historically performed waste composition studies for Orange County, including Chapel Hill and the surrounding municipalities, since 1990. A waste composition study has been

completed every 5 years, with the most recent study completed in April 2010. Exhibit 2-3 presents the Town's typical waste composition based on the 2010 study.

Exhibit 2-3. 2010 Waste Composition Study Results



Compared to Orange County and the surrounding municipalities, the composition of the Town's waste is generally higher in organics (40% vs. 30-35%) and wood waste (4% vs. < 4%). However, the Town's waste composition generally has less metal and inert debris (4% vs. 5-6%).

SCS noted the following general trends in the Orange County waste composition data since 1995, which may represent the Town's waste composition for the purposes of this Study. Paper, metal, and glass composition in the waste stream has demonstrated a consistent decline to approximately half of their initial contributions over the last 10 years. Organics (10-15%), plastic (4-6%), wood (1-2%), and yard waste (2-3%) contributions have each increased.

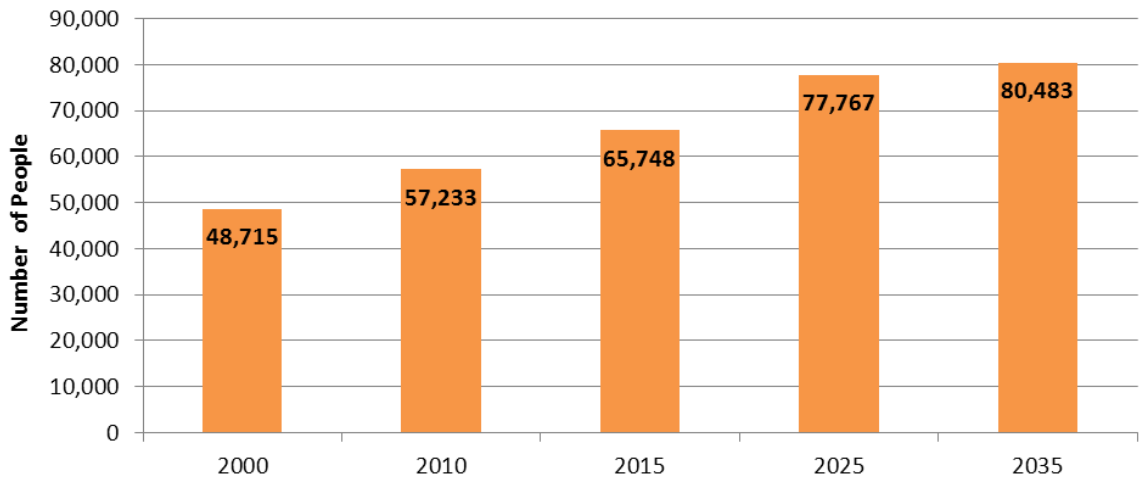
2.1.4 Town Demographics

2.1.4.1 Population Projection, Density, and Employment

According to the 2010 U.S. Census Bureau statistics, Chapel Hill records a population of 57,233 people. This includes the student population of the University of North Carolina at Chapel Hill

recorded to be 29,137, or approximately 51% of the Town population. The Town's population has increased 17.5% since 2000. Exhibit 2-4 presents the future population projections. The town limits comprise 21.12 square miles which equates to a population density of approximately 2,710 persons per square mile. According to data published by the Metropolitan Planning Organization, the Town is anticipated to grow to more than 65,700 people by 2015 and near 80,500 by 2035.By comparison, the unincorporated portion of Orange County records a population of 133,801 people. Its population has increased 13.2% since 2000. Orange County is reported to comprise 397.96 square miles, which equates to a population density of approximately 336 persons per square mile.

Exhibit 2-4. Anticipated Chapel Hill Population



According to the U.S. Department of Labor, Bureau of Labor Statistics, the Durham-Chapel Hill, NC area has reported an unemployment rate of between 7.3 and 8.3% between August 2001 and January 2012. The unemployment rate decreased to 7.3 in November and December, most likely attributed to temporary holiday positions, and has returned to 8.0% as recorded in January 2012. Unemployment in the Town has been notably lower than the state average (10.2 to 10.7%) over the same period and has remained below the national average, 8.3%, during this time. The 2010 census data indicates a median household income of $52,785, which is greater than the state-wide average of $45,570 per household.

Indicative of a university town, Chapel Hill claims over 75% of the population to have earned a bachelor's degree or higher, compared to the Orange County average of 54.4% and the state average of 26.1%.

2.1.4.2 Residential Customer Statistics

According to the most recent "Solid Waste and Materials Management Annual Report" submitted to NCDENR in August 2011, the Town provides MSW collection and disposal to 11,500 residential households. This exhibit is consistent with statistics provided on the Town's website.

According to the Census Bureau statistics, Chapel Hill is comprised of 22,254 housing units, both single and multi-family. As reported, 45% of the housing units are designated as multi-family housing (i.e., apartments, condominiums, townhomes). This distribution equates to approximately 10,015 multi-family dwellings and 12,240 single-family residential properties. The relatively small disparity (3.3%) between the Town statistics and census data may be attributed to: properties in transition between occupancy, property with other contracted collection, or census recording error (i.e., town boundaries, double-counting).

Comparatively, census data for surrounding Orange County reports 55,597 housing units with approximately 30% designated as multi-family. This equates to 16,680 multi-family properties and 33,360 single-family residences.

The census data also indicates that approximately 65% of the population has consistently resided at the same location for more than 1 year compared to 76% of the Orange County population. This trend is indicative of a more transient population associated with localities which support institutions of higher education. Based on the population data, the census reports household occupancy for Chapel Hill at 2.34 persons per household.

2.1.4.3 Commercial Customer Statistics

According to Town billing records, the commercial sector provides service to 241 paying customers, which comprise collection from 369 containers per week and approximately 562 stops. These customers are identified as having contracted with the Town for weekly collections from commercial waste receptacles (e.g., 2 to 8 cubic yard roll-off) provided to the place of business, or group of businesses, and serviced by Town front loader(s). The frequency of collections for commercial establishments varies for each customer.

The census records more than 5,700 “firms” in Chapel Hill, which is substantially greater than the number of commercial establishments serviced by the Town for solid waste collections; however, this statistic is misleading assuming a large portion of these “firms” would not require commercial waste disposal service. Furthermore, SCS understands that other Town businesses contract with private sector waste collection and disposal service(s). SCS understands new commercial customers are rarely added and suspects an opportunity exists to capture additional commercial sector market share.

In addition to these scheduled commercial collections, the Town maintains two (2) waste compactor units located in the central business district. Individual commercial customers are billed an annual fee depending on their respective level of use: high, medium, or low. Currently 53 commercial customers use the waste compactor units. These customers consist primarily of food service entities and small retail shops. According to historical Town records, the two (2) compactors collect approximately 560 tons of waste per year combined.

Lastly, the Town provides service to approximately 16 commercial establishments who utilize the 65-gallon roll-carts for disposal where their weekly volume does not justify a bulk container or where bulk container service cannot logistically be provided. The Town collects weekly for each customer up to seven (7) roll-carts for a flat fee of $250 per year and a unit cost of $36 per year for each additional cart.

2.1.5 Solid Waste Disposal Costs

As described by the Interlocal Agreement, all residential and commercial solid waste collected by the Town is disposed at the Orange County Landfill. The Town is assessed a tipping fee at the Landfill of $57 per ton for MSW, and $18 per ton for yard waste. According to the 2011 Annual Report, the Town paid $355,145 for residential MSW disposal, $431,831 for commercial MSW disposal, and $45,655 for residential yard waste disposal.

Based on an SCS survey of published tipping fees of municipal and private landfills within a 200-mile radius of the Town, the average tip fee for MSW disposal is approximately $40 per ton (see Exhibit 2-5).

Exhibit 2-5. Summary of Area Landfill Tipping Fees

Facility Name	Tipping Fees (per Ton of MSW)	Distance to Chapel Hill, NC (miles)
Orange County LF	57.00	5
Austin Quarter SW Management Facility/ Alamance County	38.00	18
South Wake Landfill	30.00	40
Upper Piedmont Environmental Landfill	32.67	46
Johnston County Landfill	33.00	60
Pittsylvania County Landfill, VA	60.00	72
Rockingham County Landfill	36.00	75
Southside Regional Landfill, VA	35.50	78
Uwharrie - Montgomery	31.00	85
Hanes Mill Road LF	34.00	85
Wayne County Landfill	30.00	93
Albemarle Landfill	28.00	96
WI-Sampson Co. LF	29.79	100
Lenoir County Landfill	60.00	101
Edgecombe County Landfill	46.50	103
Franklin County Landfill, VA	32.00	105
Brunswick Waste Management Facility, VA	36.00	107
Lunenburg County Landfill, VA	29.00	109
BFI-Charlotte Motor Speedway LF	44.00	130
Maplewood LF, VA	45.00	133
East Carolina Regional LF	60.46	140
Shoosmith Sanitary LF, VA	40.00	155
Atlantic Waste Disposal LF, VA	47.00	160
Average Tipping Fee	39.78	

2.2 SOLID WASTE COLLECTIONS

The Town provides residential solid waste collection for both single-family and multi-family properties within the jurisdictional limits of Chapel Hill. Commercial solid waste collection is provided to businesses, schools, multi-family properties, and other small enterprises that contract with the Town for either bulk container service, compactor service, or roll-cart service as described in Section 2.1.4.3.

2.2.1 Collections Policies and Practices

2.2.1.1 Single-Family Residential Customers

The Town provides each single-family property, and some smaller multi-family properties, one 65 gallon roll-cart at no charge for purposes of MSW collection by the Town. Each cart is assigned a serial number, which is recorded along with the corresponding residential address; however, these records have not been well maintained. Residential MSW collection throughout the Town is accomplished on a weekly basis and occurs on Mondays and Tuesdays according to an established routing schedule described in Section 2.2.2. Collections typically begin at approximately 6:00 a.m. in the summer and 6:30 a.m. in the winter and conclude by approximately 1:00-1:30 p.m. Town residents are expected to place their waste carts at the curb on the day of collection. Residents who do not remove empty waste carts from the curb by 7:00 p.m. on the collection day are subject to a $25 per day fine.

Missing or damaged waste carts are replaced and/or repaired by the Town at no charge to the residents. The Town maintains a minimum of 25 operating, spare carts at all times. Residents may place an unlimited number of additional waste containers and/or bags for collection along with the Town-issued waste cart. According to Town policy, these additional vessels may not exceed 32-gallon capacity, must weigh less than 60 pounds, and maintain a secure lid; however, these practices and policies are neither followed nor enforced.

Residents who are unable to roll their carts to the curb for collection may apply for an exemption. Such exemptions are typically granted for:

- Residents with physical limitation or disability;
- Elderly residents 70 years or greater; and,
- Residential properties which exhibit physical limitations to collection (e.g., steep or long driveway, difficult access).

Solid waste is collected from exempt residential properties by Town solid waste workers retrieving cans and carts from the resident's property and depositing the solid waste into small, "Scooter" trucks (i.e., pick-up truck with lined, dump bed). Town personnel indicated that in 2010, approximately 900 residents maintained an exemption for placing their carts at the curb. This represents more than 8% of the properties receiving Town collection service. SCS understands the list of exemptions has not been reviewed for some time and the Town suspects that many of these are no longer valid exemptions.

2.2.1.2 Multi-Family Customers

Multi-family properties throughout the Town rent, lease, or purchase bulk container(s) provided by a private sector vendor. The Town provides the associated collection and disposal services. Bulk containers should be appropriately sized for each property based on anticipated disposal volume and available collection vehicle access. These containers range between 2 and 8 cubic yards, but are most often 6 or 8 cubic yard containers. Town policies for multi-family customers are designed to assume one (1) bulk container per every 25 housing units. Collection from these containers is provided by the Town at a minimum of once per week at no cost. Additional weekly collection events for any container are scheduled and provided in accordance with the Town's bulk container collection fee schedule, based on the container size and frequency of collection. Collections from these multi-family properties are performed by the Town's Commercial operations utilizing front loader trucks.

Due to access constraints, typical disposal volume, or number of housing units, some multi-family properties use waste carts that are collected once per week using residential collections staff.

2.2.1.3 Commercial Customers

As described in Section 2.1.4.3, the Town provides commercial waste collection and disposal to businesses that contract for these services. In addition to businesses, the Town municipal buildings and public education buildings (K through 12, excluding UNC) are included in this customer category. As with the multi-family customers, bulk containers are rented, leased, or purchased by the business from a private sector vendor. The customer may select a collection schedule ranging from one to five times per week depending on their volume and container size, which ranges between 2 to 8 cubic yards. According to the Town, the typical customer maintains an 8-cubic yard bulk container. The fee schedule for each container size and collection frequency is posted on the Town website and depicted in Section 2.3.3.1, Exhibit 2-10.

In the more concentrated downtown business district, the Town provides two (2) waste compactor units for use by businesses that pay for this service. The SWSD charges variable fees to each business as determined by the apportioned annual waste contribution: heavy; medium; or light. These compactors are designated as "Post Office" and "South Columbia," which corresponds to their location.

2.2.1.4 Yard Waste

Yard waste collection is provided to residential customers throughout the Town and is accomplished on a weekly basis and occurs on Thursdays and Fridays using the same labor and equipment as employed for MSW collections. Dedicated yard waste roll-carts are available for purchase from the Town for $47 each; however, residents may also prepare yard waste for collection per the following methods:

- Rigid container – less than 40 gallons and less than 60 pounds;
- Paper yard waste bags;

- Bundled limbs and twigs, etc. – less than 50 pounds, less than 4 feet in length, and less than 24 inches in diameter;
- Loose piles at the curb – brush and twigs less than 3 cubic yards; and,
- Larger portable containers for rent from Public Works Department.

Small, loose yard waste (i.e., grass clippings, leaves, straw) cannot be managed in loose piles and must be bagged or containerized. No plastic bags are accepted. Large limbs and logs (exceeding 24 inches in diameter or 4-foot lengths), stumps, or land clearing debris are not collected. Specifically, the Town ordinance specifies:

> "No materials such as trees, logs, stumps, shrubbery or underbrush resulting from land being cleared shall be collected by the town and shall be the responsibility of the contractor or builder. In the event that the contractor or builder fails to remove such material, it shall be the responsibility of the owner of the property".

While this ordinance is clearly communicated as it pertains to site development activities (i.e., land clearing), it is often open to interpretation as it pertains to smaller scale residential activities (e.g., tree trimming and removal), and Town staff is periodically faced with managing large piles of wood waste and debris.

The majority of yard waste collected by the Town is placed by hand into Town compactor trucks; however, large loose piles and larger bundles are picked up using a knuckleboom truck. Christmas trees are characterized as yard waste and similarly collected. Town collections practices are equipped to manage yard waste generated by the typical resident or contracted, residential landscaping or lawn care (i.e., grass clippings and brush trimmings). Typical yard waste quantities collected range between 1 and 6 tons per compactor truck, depending on the season. Yard waste prepared for weekly collection can be as small as a pail of pinecones or as large as a full knuckleboom load.

2.2.1.5 Seasonal Loose Leaf Collection

The Town provides seasonal loose leaf collection from mid-October through mid-February each year. Under this program, residents may place loose leaves and pine straw, free of limbs and debris, at the back of the curb for collection. While this program is implemented and managed by a separate Town Department, the Streets Division, and not SWSD, it deserves consideration in this comprehensive evaluation and may provide composting/mulching value should the Town consider implementing its own yard waste program. The Town's Streets Division crews start at one end of Town and make a complete circuit at least three times during the period from October through February to give all residents the same number of pickups. The length of the collection cycles depends upon the number of leaf piles and the timing of their placement. In FY2011-12, the Town completed six collection cycles by the end of February, collecting a total of 1,249 loads of loose leaves. According to the Town operating record, the program costs range between $15,000 to $50,000 per month when collecting loose leaves depending on the volume of leaves to be collected.

2.2.1.6 Food Waste/ Grease/ Oil

Food waste, grease, and oil is not currently segregated and collected from residential customers. Since 2005, the Town has provided a grease corral in the downtown business district at the North Alley near the Wallace Parking Deck. Third-party grease collector vendors (e.g., Valley Proteins, Greenlight Biofuels, Eco-Collections Systems) stage their collection vessel(s) in the corral for use by businesses (or groups of businesses) with whom they contract for oil and grease disposal. These grease collector vendors and participating businesses are required to empty the containers a minimum of once per month, and to clean and maintain the corral routinely at their own expense. As these grease management arrangements have become an attractive business venture for most participating restaurants, it represents an ongoing maintenance issue for the Town with no direct financial return. The Town maintains the physical structure of the corral, performs repairs, and washes the surrounding area.

SCS understands the grease corral provides an ongoing challenge to the Town regarding:

- Abuse and damage to the physical structure;
- Ensuring the corral is properly operated and maintained;
- Responding to spills and maintaining spill supplies;
- Inspecting the facility;
- Protecting stormwater; and,
- Educating participating businesses and their employees in proper maintenance and spill response.

2.2.1.7 Bulky Wastes/ White Goods

Bulky items, white goods, and electronic equipment are collected at the request of a resident and scheduled with SWSD. Up to three (3) items are collected for a minimum fee of $15. Each additional item is charged an additional $5. These items are typically collected by hand and placed in a flatbed truck, or occasionally picked up with the Town knuckleboom truck or rear loader.

2.2.1.8 Construction and Demolition Debris

Construction and demolition debris (CDD) is prohibited from being included in the residential waste or commercial waste collected by the Town. Collection and disposal of CDD is the responsibility of the contractor performing work at either a residence or business and is typically provided by a private sector collection and disposal vendor. CDD collected within the Town jurisdictional limits is supposed to be disposed at the Orange County CDD landfill unit or other approved facility, which is anticipated to continue to be the practice after the closing of the Orange County MSW landfill unit.

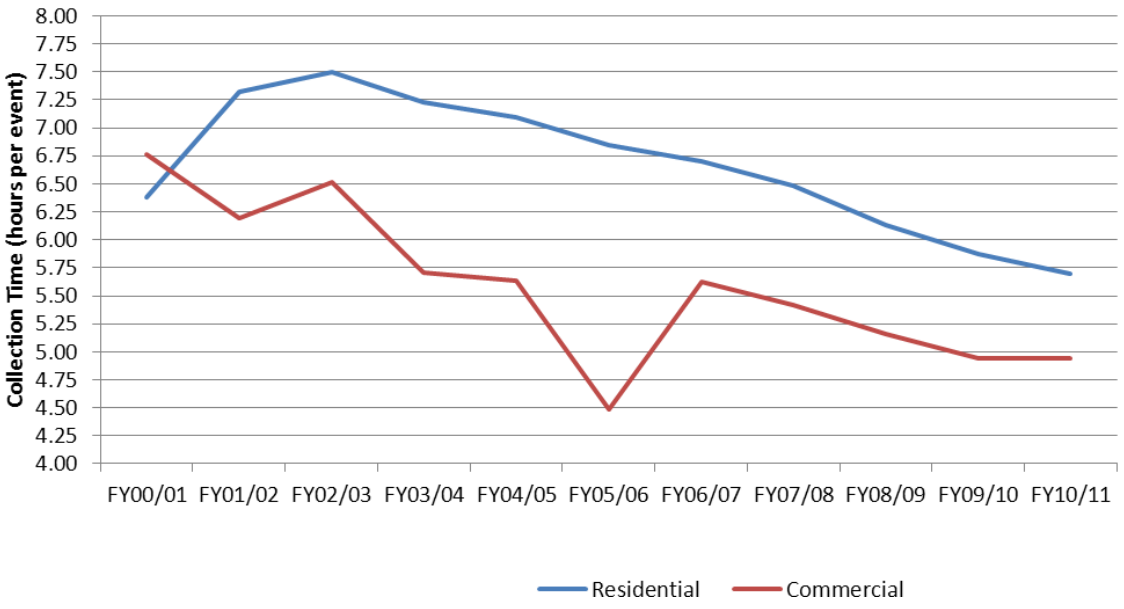
2.2.2 Current Collections Route Description

2.2.2.1 Residential Collections – MSW and Yard Waste

SCS reviewed a map provided by the Town, entitled "Sanitation Collection Routes" and dated March 2012. Residential MSW and yard waste collections are both performed along seven (7) designated routes each day to service the Town population. As described above, MSW collection is completed weekly on Mondays and Tuesdays, and yard waste collection is completed along the same routes on Thursdays and Fridays. Each of the seven (7) routes is serviced by a single collection vehicle and crew.

According to Town collections staff, the current routing configuration and the equipment and resources assigned to each, typically allow most of the seven (7) crews to collect from the entire assigned route and transport to the Orange County Landfill without making multiple trips. The Town tracks the associated labor effort for each residential route throughout the year. The current routes average between 5 and 6 man-hours to complete (see Exhibit 2-6 below).

Exhibit 2-6. Collection Times



With the exception of a few small pockets split between routes, the seven (7) collection routes appear to be relatively evenly distributed geographically across the Town service area and divided by major transportation infrastructure as described in Exhibit 2-7. The size of the Route appears to be apportioned to the relative density of the population served.

Exhibit 2-7. Collection Routes

Route No.	Weekday	Route Description (Direction/Density)
232	Monday	Southeast side of Town. East of Route 501 and North of Route 54. Relatively broad.
	Tuesday	South side of Town. South of Route 501. Relatively broad.
216	Monday	North of side of Town. Relatively broad. Intermixed with Route 204.
	Tuesday	North of side of Town. More dense. East of MLK Blvd. and South of Weaver Dairy Rd.
210	Monday	West side of Town. North of Route 501 to Cameron Ave. Smaller area and relatively dense.
	Tuesday	West side of Town. Continuing North of Cameron Ave. and west of MLK Blvd. Smaller area and relatively dense.
209	Monday	East central. Generally east of Route 501. Smaller area and relatively dense.
	Tuesday	West central. East of MLK Blvd. Smaller area and relatively dense. Mixed with 204 and 208.
208	Monday	South end of Town. Very dense. Southern Village area.
	Tuesday	West and Northwest perimeter of Town. Two small dense areas linked by Seawell School Road. Mixed with 209.
207	Monday	East side of Town. East of Route 501. Relatively broad area.
	Tuesday	East side of Town. Continuing north of Route 501. Relatively smaller area and more dense.
204	Monday	Central to Town. Vicinity of East Franklin St. Intermixed with Route 204 Tuesday collection east of E. Franklin St.
	Tuesday	North central side of Town. North of North Elliott Rd. Relatively broad with a few smaller remote pockets.

SCS understands the routing pattern has existed without change for many years. A comprehensive routing and technology study has not been performed for the Town. Similarly, neither the Town nor any consultants has employed collections routing software to evaluate the Town's collection patterns.

2.2.2.2 Commercial Collections

Commercial collections contracted by customers throughout the Town are routed according to the customers' locations, waste disposal volumes, and requested frequency of collection. The Town's commercial fleet collects 5 days per week on these established routes and schedule. Additional locations and container collections are worked into the schedule on and an as-needed basis.

Similar to residential collections the Town has tracked the labor effort associated with each commercial collection vehicle. Commercial collections average approximately 5 hours per collection day per vehicle.

2.2.3 Collections Fleet Description

The Town's solid waste fleet dispatches from the Public Works complex located on Millhouse Road. Vehicles are stored here daily in a secured, paved lot, and are serviced and maintained as necessary at the service building located on the premises. In addition, the Town complex maintains fueling facilities for all Town vehicles. Of the 25 vehicles assigned to Solid Waste Services, all but four (4) vehicles are fully depreciated. The total fleet currently represents a depreciated asset value of approximately $1.7 million and a total asset value of approximately $2.1 million.

2.2.3.1 Residential Collection

Presently the Town maintains eleven (11) rear loader compactor trucks to manage routine weekly residential MSW and yard waste collections. Seven (7) trucks are assigned to front line service and range in age from 2005 to 2011. One (1) truck is assigned to each weekly collection route. The remaining four (4) trucks are maintained as a backup fleet for any of the seven (7) front line trucks. These trucks range in age from 2003 to 2005. Each of these eleven (11) trucks generally exhibit 18 to 20 cubic yards capacity. All of the front line trucks are equipped with dual-axles, while the backups are equipped with a single-axle. Vehicle weight, storage capacity, and number of axles are critical input parameters while considering alternate disposal options transporting waste outside the city limits.

2.2.3.2 Commercial Collection

For commercial MSW collections the Town maintains three (3) front loader compactor trucks equipped with hydraulic forks to lift and dump bulk containers. Two (2) trucks are assigned to the front line and were acquired in 2010. The third truck was acquired in 2004 and is maintained as backup for either of the front line trucks. Each of these three (3) trucks exhibit 28 cubic yard capacity and are equipped with tandem axles.

2.2.3.3 Other Vehicles and Equipment

In addition to these main collection vehicles, the Town maintains:

- One (1) knuckleboom truck typically used for yard waste, purchased in 2007.
- One (1) hook-lift truck typically used for Yard Waste, purchased in 2003.
- Two (2) "scooter" trucks with dump beds typically used for exempt residential collections and roll-cart collections in the downtown business district and Southern Village, each purchased in 2006.
- Two (2) flatbed trucks typically used for bulky waste collection, purchased in 2008 and 2011.
- Three (3) general pick-up trucks, purchased in 2007 and 2008.
- One (1) passenger car, purchased in 2009.

2.2.3.4 Vehicle Maintenance and Repair

As described, the Town provides its own maintenance and repair services for all vehicles in the waste collection fleet. Maintenance and repair costs, fuel expenses, and mileage are recorded and tracked monthly for each vehicle. Using these historical records, SCS calculated the average maintenance and repair cost per mile and total operating cost (including fuel) per mile for each vehicle type as depicted in Exhibit 2-8 below.

Exhibit 2-8. Average Maintenance and Repair Cost

Vehicle Description	Maintenance & Repair Cost ($ per mile)	Total Cost Including Fuel ($ per mile)
Commercial Front Loader	1.43	2.35
Residential Rear Loader	1.38	2.28
Hooklift	1.45	1.74
Knuckleboom	0.91	1.60
Scooter Truck	0.37	0.66
Flat Bed	0.22	0.58
Pick-up/Passenger Car	0.08	0.23

2.2.4 Collections Personnel

According to the Town's FY 2011-12 budget, SWSD is comprised of 35 salaried positions. Refer to the organizational chart provided in Exhibit 2-1. Of these 35 positions, 29 are presently filled. Vacancies exist for a Solid Waste Services Inspector, one (1) equipment operator, and four (4) collectors/laborers. These vacant positions are noted as authorized but not funded for the current fiscal year.

Hierarchy in SWSD is depicted to include a Solid Waste Superintendent and two (2) Solid Waste Services Supervisors, one (1) each for commercial and residential collections. Equipment operator and collections personnel are assigned to these two (2) groups respectively.

2.2.4.1 Residential Collections Personnel

Residential collections staff are currently comprised of nine (9) Equipment Operator II positions, three (3) Equipment Operator I positions, ten (10) Solid Waste Collector positions, and one Residential Supervisor. This staff is generally assigned to the seven (7) rear loader compactor trucks, which equates to a three-man crew for each truck. An Equipment Operator II each drives the seven (7) trucks while the remaining two (2) Equipment Operator II's serve as backup drivers in the event any of the primary drivers are absent. The Solid Waste Collectors operate the truck controls, and position and load waste cans. Two (2) Solid Waste Collectors are assigned to each truck along with supplemental temporary personnel described in Section 2.2.4.4 below. Lastly, the three (3) Equipment Operator I's are assigned to each of the two (2) "Scooter" trucks and the white goods flatbed truck.

2.2.4.2 Commercial Collections Personnel

Commercial collections staff are comprised of four (4) Equipment Operator III positions and one (1) Commercial Supervisor. Each of these positions operates the two (2) front loader trucks, the knuckleboom truck, and the hook-lift truck. While the knuckleboom truck operation is assigned to the commercial collections within the Town budget, its function is primarily engaged in yard waste collection, primarily a residential collection activity.

2.2.4.3 Task-Based Earnings Structure and Full-Time Benefits

Each of the solid waste collections staff positions are full-time positions. No part-time positions are currently included in the SWSD organizational structure. SWSD collections staff currently work on a task-based payment structure. Employees are compensated their full annual salary (i.e., equivalent 8-hour workday) upon the completion of their collection route and other assigned daily tasks, and thus are not compensated commensurate with hours worked; however, as described in Section 2.2.2 above, typical residential and commercial routes comprise between 5 and 6 hours on average. Accordingly, many of the staff engage in other employment and coordinate their schedules accordingly (e.g., afternoon jobs).

Full-time benefits include: medical insurance, disability and life insurance, worker's compensation, and retirement benefits.

2.2.4.4 Overtime and Temporary Personnel

Occasionally the Town solid waste collections staff is required to work overtime. These occasions include: responding to storm events, collection delays caused by hazardous weather (e.g., ice and snow), holidays, and special events (e.g., festivals, sporting events). Review of the Town SWSD annual operating budget indicates an allowance for overtime equivalent to approximately 5% of annual salary.

At the time of this review, division positions are intentionally being held vacant, pending the results of this study. In the interim, the Town has contracted four (4) temporary personnel who supplement the Solid Waste Collector full-time positions currently authorized but unfunded in the SWSD organizational structure. In addition, the Town routinely budgets temporary labor from staffing agencies during illnesses and absences.

2.2.5 Solid Waste Collections Cost

Exhibit 2-9 summarizes SCS's review of the Town's SWSD budget for fiscal year 2012-13, depicts a comparison to the previous fiscal year, and reflects the projected percent change from the previous fiscal year.

Exhibit 2-9. FY 2012-13 Solid Waste Services Budget

Item Description	2011-2012 Budget ($)	2012-2013 Request ($)	Change (%)
Total Personnel	1,838,320	1,663,802	(9.5)
Operating Costs	103,400	103,650	.25
Fleet Usage	191,000	179,890	(5.8)
Vehicle Replacement	375,000	310,600	(17.2)
Vehicle Fuel	98,000	118,180	20.6
Subtotal Collections Cost	2,605,720	2,355,067	(9.6)
Per Ton Collection Cost	**147.22**	**132.53**	**(10.0)**
Subtotal Disposal Cost	932,000	942,350	---
Total Program Cost	3,537,720	3,318,472	(6.2)

According to the most recent "Solid Waste and Materials Management Annual Report" for the period July 1, 2010 through June 30, 2011, submitted to the NCDENR, the Town reported annual collections cost of $2,663,219 to manage a total of 17,169 tons of MSW and yard waste. This equates to $155.12 per collected ton.

2.3 SOLID WASTE REVENUE

2.3.1 General Program Revenue

In July 2008, the state of North Carolina initiated a $2 per ton annual disposal tax assessed to landfills throughout the state, based on scale receipts. A portion of these fees collected is distributed back to local government on a per capita basis to support their waste management programs. According to the Town's budget, this state contribution is estimated $20,000 per year. In recent years state contributed general revenue has been notably higher. In FY 2011-12, $39,213.27 was received. In FY 2010-11, the amount received from the state was $38,487.64.

2.3.2 Residential Collections and Disposal

Currently the Town does not assess a separate fee or tax on its citizens for residential sold waste collections and disposal. Some program revenue is generated through the Town's Special Trash Collections (i.e., bulky waste, white goods, and bulk yard waste), projected $8,000 per year. Collection of bulky waste and white goods incurs a $15 minimum fee for up to three (3) items and $5 for each additional item. Secondly, the Town provides for rental of yard debris dumpsters to its citizens. Rental fees are assessed at $20 per weekday and $25 per weekend.

Additional residential revenue is collected from the sale of yard waste roll-carts. The sales price of the roll-cart is $47. The actual unit purchase cost, currently $62.10 per cart, and fluctuates with each Town purchase. Based on historical records, yard waste roll-cart sales contribute approximately $3,000 towards annual revenues.

2.3.3 Commercial Collections and Disposal

2.3.3.1 Bulk Containers

The Town has established fees for commercial sector bulk container collection and disposal according to the size of the container and frequency of collection (up to 5 days per week). These fees are posted on the Town website and are depicted in Exhibit 2-10. These fees were updated as of July 1, 2012 and are much lower than fees charged by neighboring municipalities and other private sector vendors.

Exhibit 2-10. Commercial Sector Bulk Container Collection and Disposal Fees

Container Size	1x/week	2x/week	3x/week	4x/week	5x/week	Extra Lift
2 yard	$375	$725	$1,075	$1,775	$2,225	$50
4 yard	$550	$900	$1,225	$1,950	$2,400	$50
6 yard	$725	$1,075	$1,400	$2,125	$2,575	$50
8 yard	$900	$1,250	$1,575	$2,300	$2,750	$50

Commercial collection and disposal billings represent the largest source of revenue to the Town SWSD program. According to the FY 2011-12 budget, the Town anticipates approximately $303,500 in revenue from this service. However, billing collection remains an issue for the Town as a majority of customers participate in a partial payment option and a further portion is routinely delinquent.

2.3.3.2 Compactors

Customers using either of two (2) solid waste compactor vessels, located in the downtown business district, are billed an annual fee according to their respective usage: heavy ($1,500), medium ($750), and light ($280). These fees were established in 2004-05 and have remained unchanged. Historical records and the Town budget project that the compactors contribute approximately $30,000 in annual revenues.

Like the bulk container collection, customers typically utilize a partial payment schedule (i.e., quarterly or semi-annual); however the compactor service results in more challenging revenue collection with the Town collecting only 80% of billings. SCS suspects contributing factors to this issue are likely the smaller size of the businesses, a high rate of turn-over and/or failure, and more cyclical businesses associated with the university schedule. Furthermore, unlike its bulk container service where service may be interrupted for non-payment, the Town maintains little control over businesses continuing to use the compactors.

2.3.3.3 Roll-Carts

Commercial customers using 65-gallon roll-carts for disposal are charged a fee of $250 per year for collection of up to seven (7) carts. An additional fee of $36 per year is assessed for each additional cart. These contributions are included in the commercial sector revenue projection in Section 2.3.3.1 above.

2.3.4 Residential and Commercial Fines

A marginal contribution to revenue includes residential and commercial solid waste fines for failures to comply with the established Town policies, for example:

- Failure to remove residential roll-carts from the curb;
- Commercial roll-off citations;
- Disposing of unacceptable waste in commercial compactors (e.g., cardboard); and,
- Leaving waste on the ground in front of compactors or roll-offs.

Based on historical records, revenue from these citations was $2,025 for FY 2010-11. Revenue to date in FY 2011-12 was $9,400 (using two part-time retirees to supplement the vacant Solid Waste Inspector position). The revenue contribution from fines is estimated to be similar to FY 2012-13.

2.4 CURRENT RECYCLING SYSTEM

Orange County Recycling (OCR), a division of the Orange County Solid Waste Management Department, offers a comprehensive and integrated recycling program throughout the County with programs for both the residential and commercial sectors. Recycling services are provided to the unincorporated areas of the county as well as the Towns of Chapel Hill, Carrboro, and Hillsborough.

2.4.1 Summary of Waste Reduction Goals

In 1997 Orange County and the incorporated municipalities of Chapel Hill, Carrboro, and Hillsborough each adopted a solid waste reduction goal of 61% per capita. Towards this objective, Orange County has made great progress, improving from 50% measured in 2007-08 to 56% measured in 2009-10. During FY 2010-11, Orange County was recognized for the second year in a row as having the highest waste reduction rate in the state at 56% again. This rate is calculated by dividing the total tons of waste landfilled that originated in the county, regardless of where the waste is disposed, by the total population for each year.

Orange County, including the Town, is committed to reaching and exceeding this waste reduction goal. Particular consideration should be given to the potential impacts any waste disposal scenario option may have on meeting this objective.

2.4.2 System Description

The various recycling programs operated by the County share staff, vehicles and equipment; hence, accounting for costs specific to the Town of Chapel Hill is difficult. It is also worth noting that the County operates several other materials recovery and recycling programs, primarily located at the landfill including scrap metal and white goods recovery, yard waste mulching, clean wood waste grinding, oyster shell and tire collection that are not currently funded by the recycling 3-R fee thus not always considered a formal part of recycling. These programs infrastructure and operations are integrated into the overall solid waste management

department activities and account for over ten thousand tons of additional diversion annually thereby adding to the County's highly effective and successful waste reduction effort.

Recycling services provided by OCR to the Town are presented below.

2.4.2.1 Residential Recycling Programs

OCR provides residential recycling services for the Town through the following programs:

- **Urban Curbside Recycling Collection.** The County contracts with a private hauler (currently Waste Industries) for once weekly curbside recycling collection for 11,800 residences (single-family homes or duplexes) in the Town. Households are provided two bins. Until July 1, 2012 one was designated for bottles/cans/jars, the other one for mixed paper. OCR initiated single-stream collections in July 2012 using these bins and proposes to transition to collection using 95-gallon roll carts in 2013.

- **Multi-Family Recycling Programs.** County staff collects recyclable materials from recycling sites which are located at over 95% of multi-family complexes (apartments, town homes, and condominiums) in the Town. Multifamily recycling sites use labeled wheeled carts for collecting materials. This program also transitioned to single stream in July 2012.

- **Household Hazardous Waste (HHW) Collection Program.** The County accepts HHW from all County residents and small businesses that are Conditionally Exempt Small Quantity Generators (CESQGs) by Federal Law at a permanent facility operated under contract at the Orange County Landfill 6 days per week. The five staffed solid waste convenience centers also collect motor oil, oil filter, anti-freeze, batteries and electronics from residents only. The County recycles much of the HHW such as antifreeze, motor oil, oil filters and some household chemicals, batteries and electronics. Some liquids like paint and solvents are blended for industrial fuel and that which cannot be recycled, reused, neutralized or burned is safely stored in a hazardous waste landfill. A second permanent HHW collection site is scheduled to open in northern Orange County in early 2013.

- **24-hour Recycling Drop-Off Sites.** The County operates five recycling drop-off sites, three of which are located in the Town. Residents can use these sites to recycle the same materials collected through the curbside program. County employees transport recyclable materials from the drop-off sites to the County Landfill for processing and then transfer to markets.

- **Solid Waste Convenience Centers.** The County operates five solid waste convenience centers located in the unincorporated areas of the County but open to all County residents. These centers accept recyclable materials and some hazardous materials (see HHW above) in addition to waste, bulky items, wood, scrap metal, tires and yard waste. Similar to the Recycling Drop-Off Sites, County employees transport material from the convenience centers to the County Landfill for processing and then transfer to markets.

2.4.2.2 Commercial Recycling Programs

OCR provides recycling services for the Town's commercial sector through the following programs:

- **Government Building Recycling.** A County employee uses a box truck to collect recyclables from every government building in the Town. An additional County employee uses a front loader collection vehicle to collect all the cardboard at all of the government buildings and schools. Public parks now have recycling collection service for paper, cans and bottles as well. Thirteen pedestrian recycling bins were installed along Franklin Street by the Town of Chapel Hill last year and are collected weekly by the County. Bin design and choice were determined by the Town in consultation with the County and several older, less effective bins were removed when these were installed.

- **Commercial Recycling Collection.** The County's commercial recycling program accepts all beverage containers and other recyclable materials including aluminum cans, steel cans, empty aerosol cans, aluminum foil and trays, glass bottles and jars, all plastic bottles, non-bottle containers #2, #4 and #5, beverage and food cartons and all paper except corrugated cardboard. The County provides carts and collection services. Where available, Commercial Recycling services are provided at no direct cost to the participating businesses (costs are borne through the County's 3-R Recycling Fee described in Section 2.4.3 below).

- **Schools Recycling.** The County collects recyclable material from all the K-12 public schools in both the Orange County and Chapel Hill-Carrboro school systems. In both public schools systems there are 34 total recycling locations, 19 of which are part of the Chapel Hill Carrboro City school system located within Chapel Hill and Carrboro corporate limits. In August 2011, the County began a pilot collection program picking up pre-consumer food waste from three schools for composting. The purpose of the pilot is to determine how best to divert this waste stream from the schools' dumpsters and from within the schools' food preparation systems in particular. The pilot is ongoing and could be expanded depending upon results.

- **Food Waste Collection.** The County contracts with a private hauler (currently Brooks Contractor) to collect and compost food waste and other compostable organic material from select local businesses. This program accepts source-separated organic materials such as kitchen and produce department prep waste, post-consumer plate waste, and other compostable organic materials from local restaurants, grocery stores, and food service establishments for composting. The finished compost is available to purchase locally at the County Landfill.

- **24-hour Recycling Drop-off Sites.** These sites are available to commercial users and a 2007 survey showed that many small businesses and non-profits use them.

- **HHW Facility.** This facility is open to CESQGs (those with less than 220 pounds per month). Many painting contractors use the facility.

2.4.2.3 Recyclable Material Processing and Marketing

All collected recyclable material gets consolidated at the recycling area of the County Landfill. The recycling area consists of a large concrete pad (about 15,000 square feet) that is partially covered on which collected recyclables are dumped from the collection vehicles. Gross contaminants are removed as time permits.

Waste Industries, the private hauler contracted to collect recyclable material curbside from Town residences, delivers the recyclables to the recycling area at the County Landfill. Prior to June 2012 a two-stream system was in use in which fiber was transferred and sold to Sonoco in Durham. Commingled cans and bottles were transferred and sold to FCR/ReCommunity in Greensboro. Beginning in July 2012, the material is delivered to the County site single-stream, inspected by County staff for contaminants and loaded into walking floor trailers for transfer for sale and processing at the Sonoco MRF in Raleigh. Electronics are transported to Metech in Creedmoor, NC, and rigid plastic are transported to Blueridge Plastics in Eden, NC, Sonoco in Raleigh, NC or other plastics recyclers in the region depending on market value at the time.

There is one (1) County employee that manages the quality control and loading of single stream material. Two (2) more County employees transport single stream and rigid plastic to market. The electronics recycling vendor currently collects the County-prepared electronic recycling material at the landfill property and transports the material to their property for further processing and sale to end users.

2.4.2.4 Vehicles and Equipment Used for Recycling Programs

The County uses various vehicles and equipment to operate its recycling programs as presented in Exhibit 2-11 below. The estimated resources allocated to the Town recycling efforts are also depicted therein. The County contracts Urban Curbside Collection services, HHW, and Commercial Food Waste Collection services. The remaining programs are staffed by County employees and equipment is provided by the County.

The County employs three (3) Supervisors to manage the recycling programs and the program's 15 dedicated employees. Additional administrative staff answer phone inquiries, and the County program also allocates 1.5 employees to recycling education and community outreach. A full-time on-site HHW contractor staffs the HHW facility.

Exhibit 2-11. Vehicles and Equipment for County Recycling Programs

Recycling Program	Countywide Vehicles & Equipment	Town Programs Vehicles & Equipment
Urban Curbside Recycling Collection	5 trucks (owned and operated by Waste Industries) with low entry, dual drive cabs and bodies that have hoppers on both sides	2 to 3 trucks
Multi-Family, Commercial, Schools, and Rural Recycling Collection Programs	6 trucks 2 standard cab trucks with hoppers on one side and 4 with low entry, dual drive cabs and bodies that have hoppers on one side	2 trucks
Drop-Off Sites and Convenience Centers	1.5 Hook Trucks	0.5 Hook Trucks
Toxics Reduction Improvement Program (TRIP)	1 Pickup Truck 12 Trailers, forklift, Electronics warehouse, HHW building	PRO RATA SHARE of 40% based on # households in Chapel Hill as % of County
Corrugated Cardboard Collection at Drop-Off Sites, Government Facilities and Schools	2 Front Loader Trucks	0.5 – 1 Front Loader Trucks
Commercial Food Waste Recycling	2 Front Loader Trucks owned and operated by Brooks Contractor	2 Front Loader Trucks
Government Facilities Recycling	1 Box Truck	0.5 Box Truck
Processing and Hauling	2 Road tractors, 2 walking floor trailers, 1 horizontal baler, 1 rubber tire loader	All equipment shared among programs and by all users

Note: All Solid Waste Department equipment except a few pieces of specialized landfill equipment is shared among all divisions and used in an integrated manner.

2.4.2.5 Solid Waste Management Education and Outreach Services

Orange County offers comprehensive waste and recycling education services to schools, businesses, non-profit and faith-based organizations, civic groups, governmental organizations, and the public. Services include landfill tours, compost education and compost bins for sale, waste assessments, information and displays at special events, newsletters, and regular columns and advertisements in local media.

2.4.3 Quantity and Characteristics

In FY 2011-2012, OCR recycled just over 15,600 tons of material from all recycling programs in the County. Exhibit 2-12 presents quantities of recyclable material by program and estimates the portion that originated in the Town. Exhibit 2-13 presents the recyclable material quantities by material type. Note that the total quantities in Exhibit 2-12 do not match Exhibit 2-13 as the quantity in Exhibit 2-12 includes contaminants that were removed prior to marketing.

Exhibit 2-12. Recycling Material Quantities by Source, FY 2010-11

Recycling Program	County-Wide Annual Tonnage	Town of Chapel Hill Estimated Tonnage
Urban Curbside Recycling Collection [1]	3,397	2,178
Rural Curbside Collection	1,867	0
Multifamily Collection [2]	1,125	628
Drop Off Sites and ConvenienceCenters[3]	5,107	1,532
Toxics Reduction Improvement Program (TRIP) [4]	760	304
Commercial Recycling Collection [5]	1,089	871
Commercial Food Waste Recycling [6]	1,985	1,588
Government Facilities Recycling [7]	143	72
Schools [8]	139	78
Total Recycling	15,612	7,250

Notes:
1. The Town's portion of Urban Curbside Collection is proportional to the number of single-family households and duplexes served (11,800 in the Town out of 18,400 county-wide).
2. The Town's portion of Multi-Family Collection is proportional to the number of multi-family units served (9,115 in the Town out of 16,345 county-wide).
3. The Town's portion of material from Drop-Off Sites and Convenience Centers is proportional to the number of sites located in the Town (3 in the Town out of 10 county-wide).
4. The Town's portion of material from TRIP is proportional to the number of households (22,254 in the Town out of 55,597 county-wide).
5. The Town's portion of material from Commercial Recycling Collection is proportional to the number of commercial customers (about 80%).
6. The Town's portion of material from Commercial Food Waste Recycling is proportional to the number of customers that utilize the program (about 80%).
7. The Town's portion of material from Government Facilities Recycling is proportional to the size of local government (about 50%).
8. The Chapel Hill Carrboro City School's portion of material from schools collection program is proportional to the number of schools (19 in the district out of 34 county-wide). This tonnage does not include cardboard collection that occurs at the school. That is included in the drop-off site tonnage as part of overall fiber as it is collected on those routes.

Exhibit 2-13. Recycling Material Quantities by Commodity, FY 2010-11

Material	FY 2011/12 Tonnage
All Paper (includes newspaper, phonebooks, glossy magazines, and mixed paper)	5,329
Corrugated Cardboard	1,464
Commingled Bottles/Jars/Cans	5,854
Non-Bottle #2 and #5 Rigid Plastics	146
Toxics Reduction Improvement Program (includes hazardous waste, motor oil, filters, batteries and electronics)	760
Food Waste and Animal Bedding	1,985
Total Recycled	15,538*

Notes:
1. The difference in total tonnage between Exhibit 2-12 and 2-13 is due to discarding some incoming materials that could not be sold.
2. After July 1, 2012, the paper and commingled bottles and cans are being sold as single stream material.

2.4.4 Recycling System Costs

The Orange County Solid Waste Management Department is responsible for all public recycling efforts in Orange County, including those that serve the Towns of Chapel Hill, Carrboro, and Hillsborough plus the services for residents of unincorporated Orange County. In FY 2011-12, the annual budget for all recycling services was more than $4 million including support services. The County paid their contractor, Waste Industries, $4.17 per household per month. The annual 3-R fee of $52 per urban household per year covered the costs of collection plus the additional costs for program administration, management and replacement bins for the Urban Recycling Collection Program.

The 3-R Fee (waste reduction, reuse and recycling fee) provides the vast majority of the funds used by Orange County to pay for the costs of the recycling programs, with the remaining funds coming from revenue from the sales of recyclable materials.

The 3-R Fee is a multi-part/tiered fee that is assessed annually and billed on the property tax bill. All improved properties in Orange County are subject to the Basic Fee which pays for recycling services generally available to all. A separate Collection Service Fee is assessed to all multi-family units and households depending on the level of service. Residents in the Town are charged either the Multi-Family Unit Recycling Fee or the Urban Curbside Recycling Fee (for single-family homes and duplexes), as presented below in Exhibit 2-14.

Exhibit 2-14. County Fees for Recycling Applicable to the Town

Fee Type	Description of Services	Fee
Basic Services Fee	Covers costs of recycling and waste reduction services generally available to all residences and qualifying businesses throughout Orange County including public education, hazardous waste services, electronics recycling, recycling drop-off sites, and administration.	$37/unit/year
Plus one of the following:		
Multi-Family Unit Recycling	Covers the costs of the multi-family recycling collection program (including related indirect expenses). The multifamily recycling program collects recyclable materials in roll-carts from recycling sites established on the serviced property.	$19/unit/year
Urban Curbside Recycling	Covers the costs of urban curbside recycling program (including related indirect expenses). The urban curbside recycling program collects recyclable materials in blue recycling bins every week from eligible properties within the town limits of Chapel Hill as well as Carrboro and Hillsborough.	$52/unit/year

In summary, multi-family units are charged $56 per year ($19 plus $37 or $4.67 per month) for County-provided recycling services and single-family households and duplexes are charged $89 per year ($52 plus $37 or $7.42 per month).

2.4.5 Recycling System Revenue

Revenue from selling recyclable materials fluctuates according to the quantity of material collected and the market value of the various materials. In FY 2011-12 the County received

about $830,000 from the sale of recyclables; however, this amount was substantially lower in 2008 and 2009 when recycling markets were at a historical low.

In FY 2011-12 commingled bottles/jars/cans were sold to ReCommunity in Greensboro. The County has received revenue as high as $60/ton but at the end of the year they received around $30/ton.

Fiber was sold to Sonoco in Durham. Sonoco paid a higher price for mixed paper if the County also sold them its corrugated cardboard. The County typically receives "High Yellow Sheet" (terminology is from a paper markets publication) minus $25 for mixed paper, newsprint, and magazines; and High Yellow Sheet minus $10 for corrugated cardboard. Sometimes the County bales mixed paper to receive High Yellow Sheet minus $10.

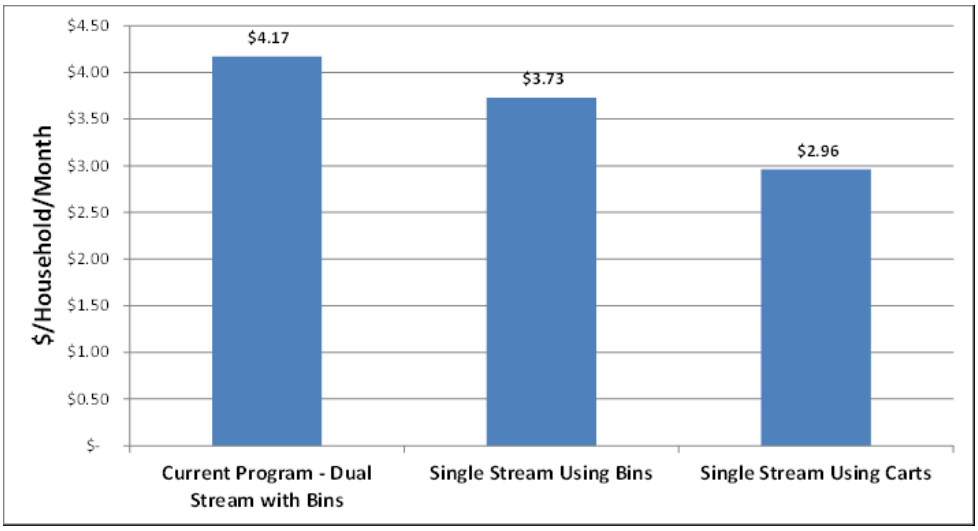
The County typically is paid between $.03 and $.08 per pound for baled rigid plastic delivered by Orange County to a processor in Reidsville NC.

Beginning in July 2012, fiber, cans and bottles were sold as commingled material to Sonoco in Raleigh at $43 per ton. That price will be periodically analyzed and adjusted as market conditions or product quality change.

2.4.6 Planned Recycling Program Modifications

The County implemented single-stream recycling for residential curbside collection programs as well as Drop-Off Sites and Convenience Centers in FY 2011-12. When re-bidding the Urban Curbside Recycling Collection contract, the County will not dictate the method for private haulers to collect recyclables; however, it is expected that the selected hauler will bid a lower cost for using fully automated collection methods. First year costs and preliminary estimates for cost of recycling single-stream in carts are presented in Exhibit 2-15. The County will utilize the expected reduction in collection costs to fund the purchase of carts for all residences.

Exhibit 2-15. Current and Expected Costs for Urban Curbside Collection Utilizing Single Stream Recycling



2.4.7 Development Review/Solid Waste Permitting

Orange County Solid Waste participates in the Town's development review process. The County reviews all plans and specifications with regard to site plan review, recommendations for solid waste permit approvals, solid waste plan evaluation, adequacy of recycling infrastructure, service access, deconstruction/demolition minimizing waste during construction, use/reuse of recycled content materials in construction, adherence to Regulated Recyclable Materials Ordinance (RRMO), ensuring compliance with Solid Waste design standards, etc.

2.4.8 Enforcement

The County staff assists Town staff in the enforcement of both state- mandated and local RRMO related landfill bans as well as enforcement at the point of disposal. Enforcement support for illegal dumping and improper use of recycling sites/containers within the Town is also provided.

3.0 RECYCLING PROGRAM EVALUATION

3.1 RECYCLING OPTIONS

This section presents an evaluation of the Town implementing its own recycling program to include collections, processing, marketing, and revenue recovery. Three options for the Town are assessed:

- Continue participation with the existing recycling services provided by Orange County (the County), and initiate a new Interlocal Agreement with Orange County that identifies metrics of success and governance for the recycling program.

- Contract with a new, third-party collections and hauling firm to operate a Town-managed recycling program for all or part of the recycling services currently provided by the County.

- Create a Town-operated recycling program in which the Town would assume direct operational responsibility for all or part of the recycling services currently provided by the County.

A summary description of services provided and the advantages and disadvantages of each option are discussed below.

3.1.1 Option #1: Continued Participation With the Existing County-Provided Recycling Services

SCS evaluated the recycling program services currently provided by the County, as described in Section 2.4 above. Ongoing participation with this program presents the following advantages and disadvantages when compared with other service options considered in this evaluation.

3.1.1.1 Advantages

- Based on SCS's general experience with other municipal recycling programs, the current service level provided by the County is generally accepted to be above average. The County operates a comprehensive recycling program that incorporates a wide array of materials and provides service to a vast number of Town customers including residents (both single-family and multi-family), businesses, government buildings, and schools. In addition the County program provides excellent educational and community outreach efforts that explain the recycling programs and encourages participation.

- The current recycling programs are successful. In 2011, North Carolina Department of Environment and Natural Resources reported that Orange County had the fourth highest per capita recovery in the State at 268.1 pounds per person per year.

- The County provides uniform public education about recycling that is consistent for a mobile population that lives and works in different parts of the County.

- The County's fees seem to be reasonably competitive. According to "*The Benchmarking of Residential Solid Waste Collection Services: FY 2008 Report"* by SWANA, the average monthly fee for curbside recycling services is $6.01 per residential unit. Orange County provides curbside recycling collection services for a monthly fee of $4.33 per single-family household or duplex and $1.58 per multi-family unit. A discussion of Orange County's Waste Reduction and Recycling (3-R) fee structure is presented in Section 2.4.4 of this report.

- The County plans to implement a single-stream recycling program which could provide each single-family household or duplex with a recycling cart without increasing the annual recycling fee. The County will use the savings in curbside collection services to pay for the carts; hence, residents will benefit from increased convenience without incurring additional fees.

- In addition to curbside collections, the County operates five solid waste convenience centers that accept recyclables and five 24-hour recycling drop-off sites, making participation convenient for most users.

- The County has existing contracts in place with several recycling markets in the area.

- Continuing participation with the County program would require no additional capital investment or increase in professional salary expense for the hiring of additional Town employees to staff and manage its own program.

3.1.1.2 Disadvantages

- The Town does not have direct control over processing and marketing of recyclable materials it generates and accordingly cannot explore revenue sharing arrangements to cover a portion of its recycling operational costs.

- The Town cannot explore the potential to combine waste hauling costs with transport costs of hauling recyclable materials to market.

- The Town lacks control of the recycling program design and operation.

3.1.2 Option #2: Recycling Programs Provided by Contract With a Private Hauler

Currently, the County contracts with Waste Industries for the collection of recyclables from single-family homes and duplexes in the Town. County employees collect recyclables from multi-family properties and some businesses in the Town. Option #2 would allow the Town to be the entity to contract directly with a private hauler (e.g., Waste Industries) for the collection of recyclables from single-family homes and duplexes in addition to multi-family properties and businesses. In structuring a contract, the Town would decide which entity, the Town or vendor, would procure, manage, and distribute recycling bins or carts.

3.1.2.1 Advantages

- By utilizing a third-party contractor/private hauler under contract to the Town, the Town will avoid direct capital costs for new recycling collection vehicles and new recycling carts. Similarly, the Town will avoid additional professional salary costs associated with hiring a potentially significant number of new personnel to manage its own program. However, the Town would retain management personnel to oversee the contractor, manage the program and provide outreach and education to its residents.

- With implementing third-party contracting for its recyclables, the Town may usurp more control over its recyclable materials than is presently afforded by the County program. The Town could, through its own contract, explore opportunities for increased recycling revenue through various revenue sharing arrangements. Recycling revenue can vary substantially from month to month depending on market conditions. Municipalities that receive a higher revenue share when markets are high will also have a risk of receiving no revenue or even paying the market to take the recyclables when markets are low. For this reason, municipalities often opt to assume less risk by accepting a smaller share of the revenue with the contractor. The Town would need professional guidance to establish revenue sharing terms in the contract to control its risk.

- The Town could control the recycling collection schedule and coordinate it with the residential pickup days.

- SCS is aware of other experienced private haulers in recyclables collection and management that are capable of providing quality recycling collections. This would promote competitive bids for the Town service.

3.1.2.2 Disadvantages

- Based on a cursory survey of relative industry service rates, SCS believes it is unlikely, but not impossible, that the Town would receive a more competitive bid than the County currently provides. The County presently dominates a large service area in the region, and as a result, has more bargaining power and can get bulk discounts for operating their program and managing collected materials.

- Soliciting a Request for Proposal for Recycling Services and subsequent contract negotiations would require industry-specific expertise to minimize future contract disputes and public relations issues from service levels that might be less than anticipated.

- While there are contract instruments, such as bid and performance bonds, that can mitigate the chances of service disruptions under a third-party contract program, the risks of such disruptions are still greater than if it the Town operated its own program.

- Contract oversight is needed to ensure that the Town is receiving the expected level of service for the appropriate contract costs. SCS notes that under this scenario the Town may potentially incur incremental salary costs in the form of existing management staff providing contract management of the third-party recycling collections program.

3.1.3 Option #3: Town-Operated Recycling Programs

Under this scenario, the Town would operate its own recycling program to collect, manage, and market collected recyclables from single-family homes and duplexes using Town resources. This would require significant capital investment by the Town for vehicles and equipment to collect materials, a facility to repackage material into larger vehicles for transport to market, and hiring of staff to support its program.

Additionally, this option may include the Town taking over recycling services provided by the County to the Town's multi-family homes, businesses and recycling drop-off sites.

3.1.3.1 Advantages

- The Town would retain the maximum level of control if it operated its own curbside and drop-off collection programs. It would control the level of service (which homes or businesses get service and when they get it).

- Implementing a Town-operated program presents opportunities for expansion into other service areas (e.g., organics diversion, collection, and processing; yard waste operations; mulching and composting, etc.), and potentially capitalize on capturing a larger, regional market share if it assumes part or all services currently provided by Orange County.

- The Town presently has the personnel and infrastructure in place needed to properly service recycling collection vehicles.

- Generally speaking, the collection of residential solid waste is one of the most appreciated and visible services provided by a Town to its residents. The current County recycling service is also very well received and appreciated, and the assumption of this service by the Town should only result in an improved public perception of the worth of overall Town services.

3.1.3.2 Disadvantages

- Capital outlays for collection vehicles, carts, and drop-off containers will be required.

- The Town will incur professional salary expenses to hire and supervise personnel to directly collect recyclables. Additional customer service personnel may also be needed to properly address the incoming calls for missed collections, damaged/stolen carts, and new service. However, there is an existing management structure for waste collection that would only need a slight expansion to also manage a Town-operated recycling program.

- The Town will have to market and transport the collected recyclable materials, including logistics challenges and inventory controls.

- The Town will incur additional equipment maintenance and usage costs to operate other vehicles and materials processing equipment.

- Because the Town represents a significant portion of the current County recycling program, the County would need to completely restructure its program to continue to provide recycling services to the Towns of Carrboro and Hillsborough and the unincorporated areas of the County.

- The established regional public education and outreach program would no longer be centralized and the Town would incur additional program costs to establish its own public education program for recycling.

- Recycling participation, material volume, and quality could decline if a Town-operated program differed from other regional recycling programs provided by the County due to confusion of what can be recycled and where it can be recycled.

3.2 FINANCIAL ANALYSIS OF TOWN-OPERATED RECYCLING OPTION

With this financial analysis of a Town-operated recycling program, SCS thought is prudent to evaluate a phased approach to estimating the value of the recycling service Orange County currently provides to Town residents. While our analysis of comparative recycling services recognizes that the Orange County recycling program provides many levels of service to Town residents to include:

- Curbside residential collections,
- Multi-family unit collections;
- Commercial sector service;
- Convenience centers and drop-off locations;
- Household hazardous waste and electronics recycling;
- Automotive waste recycling (i.e., used oil, filters, etc.); and,
- Educational and public outreach programs.

This analysis begins by first analyzing the cost to the Town of providing the core services of curbside residential recycling for the estimated 11,500 households in the Town. This phased analysis assumes that if these core services, implemented through a Town-operated program, are economically viable, additional layers of service, comparable to the current Orange County service, may be evaluated.

3.2.1 Curbside Recycling Collection for Single-Family Homes and Duplexes

Based on SWANA's "*The Benchmarking of Residential Solid Waste Collection Services: FY 2008 Report",* the average number of residential units served by a collection crew using a fully-automated collection method in North Carolina was 121 homes per hour. For the purposes of this financial analysis, SCS has assumed that each collection crew would spend approximately 6.5 hours per day collecting recyclables and 1.5 hours a day transporting recyclables, thus a collection crew can collect from about 4,000 homes during a 5-day workweek. SCS notes that under the Town's current task-based performance structure, the staffing necessary to operate this program would likely have different performance metrics than the residential or commercial collections staff.

While SCS recognizes innumerable scenarios exist pursuant to configuring collections staffing, routing, and equipment to implement a Town-operated recycling operation, our assumption of a 5-day workweek appeared to be the least cost option, requiring the least capital investment. Under this scenario, SCS anticipates the Town would need at least three front line automated collection vehicles to perform weekly collection at all single-family households during this 5-day schedule. Compressing the collection schedule to 2 days to match the Town's current MSW collections schedule would likely double this capital investment to provide additional trucks and crews to staff simultaneous collections routes. Apart from program costs, other intangible factors may influence program configurations.

Capital costs necessary to implement a Town-operated recycling program assuming a 5-day workweek are presented in Exhibit 3-1. Capital costs presented herein do not include an aggregation facility where material is aggregated into a larger trailer for transport to market. These discussions are presented further in Section 9. Similarly, the Town may elect to establish a solid waste transfer station with an aggregation area for recyclables or build a concrete pad similar to the one used by the County. It is assumed that the Town would need to purchase four collection vehicles (three for weekly operations and one spare vehicle). The capital costs were amortized at 5% interest for 7 years.

Operating expenses are based on three full-time drivers (assuming backup drivers can be provided from existing staff when needed) for the fully-automated collection vehicles at an annual loaded salary of $55,000 each, or $165,000 in total salary. Operating costs are presented in Exhibit 3-2. Based on SWANA's "*The Benchmarking of Residential Solid Waste Collection Services: FY 2008 Report,"* the average maintenance cost of fully-automated collection vehicles is about $40,000 per vehicle per year.

Exhibit 3-1. Summary of Capital Costs for a Town-Operated Curbside Recycling Collection Program

Item	Cost
Number of Households	11,500
Number of Carts	11,500
Average Cost per Cart [1]	$50
Number of Collection Vehicles	4
Average Cost per Vehicle [2]	$230,000
Total Capital Costs	$1,495,000
Amortized Monthly Cost per Household	$1.84

Notes:
1. Based on Orange County cost projection of $948,500 for 18,970 carts depicted in board memo dated 2/21/12.
2. Capital Cost of automated collection vehicle, consistent with Pro Forma modeling assumptions in other scenarios.

Exhibit 3-2. Summary of Operating Costs for a Town-Operated Curbside Recycling Collection Program

Item	Cost
Salary	$165,000
Maintenance	$160,000
Fuel	$30,00
Total Operating Costs	$355,000
Monthly Cost per Household	$2.51

Adding amortized capital cost to monthly operating cost per household results in a total collection cost of $4.35 per household per month. This does not include the processing costs or transportation costs of aggregated recyclables to market.

3.2.2 Other Recycling Services

The financial analysis of the residential curbside recycling program suggests that adding additional recycling programs comparable to the Orange County program would not be economically advantageous. The costs for the Town to provide, staff, operate, and manage these additional services (multi-family collections, convenience drop locations, and educational programs, etc.) would only drive up the cost of the total recycling program. The incremental material volume and associated revenue recovered from these additional programs is not likely to help offset the overall program costs.

Furthermore, recognizing the ongoing presence of the Orange County program and its convenience centers and drop-off locations, a Town-operated program would have less control over its residents using Town-provided drop locations versus County-provided drop locations. In the absence of Town-directed collections, Town residents may be inclined to continue using Orange County drop locations if convenient.

3.3 SUMMARY OF COMPARABLE RECYCLING PROGRAM OUTSOURCING COSTS

With this analysis, SCS reviewed bid costs recently solicited by Orange County for the collections of materials managed by its recycling program to include: curbside residential customers; commercial customers; multi-family customers; and, convenience centers. A bid tabulation for these services was provided in an Orange County Board of Commissioners, Action Agenda Item Abstract, dated April 17, 2012, presenting the renewal of the Urban Curbside Recycling Services Contract. As discussed above, the contract was renewed with Waste Industries for cost to the County of $2.96 per household per month, assuming the County procured the collection carts.

By comparison, four (4) other reputable firms bid for the services with a range of costs to the County of $4.00 to $5.24 per household per month, excluding the collection carts. Program collections costs for the third-party vendor to provide the collection carts ranged from $4.26 per household per month to $7.24 per household per month.

Notably, Orange County appears to be getting a good value from its current vendor, Waste Industries. Furthermore, these recycling collection program bid costs represent that by outsourcing a Town-only recycling program, the Town would not likely anticipate program cost savings compared with the current Orange County program or a Town-operated program. In addition, these materials collection bid costs do not include the material processing, marketing, and market transportation costs currently provided by the Orange County program. Lastly, due to the smaller material volumes anticipated from a Town-only recycling program, comparable bid prices for Town-only collections are anticipated to be higher due to economies of scale.

3.4 SUMMARY FINDINGS

SCS recommends that the Town continue to participate with the County to provide recycling services to its residents and businesses for the following reasons:

- A Town-operated program is estimated to cost $4.32 or greater for each single-family household, per month, not including costs necessary for processing and transporting materials to market. The County currently charges $4.33 per single-family household per month. While the projected costs of a Town-operated recycling program is approximately equivalent to the Orange County program, SCS suspects that any improvements in these cost projections would not likely begin to cover the necessary materials processing and transportation costs for the Town to manage the recyclables collected from all 11,500 Town single-family households. Moreover, the County is in the process of implementing single-stream recycling collection with roll-carts which is projected to lower the County collection cost, and provide Town residents with increased convenience (i.e., 95-gallon recycling collection carts) and the ability to recycle additional materials without increasing its fees.

- Implementing additional layers of recycling service comparable to the Orange County program (e.g., convenience centers, drop-off locations, multi-family collections, etc.)

is anticipated to further contribute to the cost of a Town-operated program while generating marginally increased material volume and revenue.

- A third-party contract is not likely to bring more value/savings to the Town or its residents. There is also an added risk of service impacts by replacing a proven and valued service.

- Inviting a third-party contractor to replace the County-provided service exhibits a negative impact to regional collaboration.

SCS suggests initiating a new Interlocal Agreement with Orange County that identifies metrics of success and governance for the recycling program.

3.5 CONDITIONS FOR CONTINUED OBSERVATION

SCS recommends that the Town continue to observe the following conditions and evaluate future developments that may affect the Town's costs to continue participation in the County's recycling program:

- Adjustment to the recycling fees after the Orange County Landfill ceases to accept MSW.

- Consistent and equivocal application of the 3-R Fee to Town residents and businesses.

- Value of the commodity markets for recyclable materials necessitates Town-program participation to capture this revenue.

- Development of a transfer station with capabilities to manage recyclables enables recyclables

4.0 SOLID WASTE COLLECTIONS EVALUATION

During the week of April 16 through 20, 2012, SCS conducted field observations of solid waste collections practices and programs in the Town of Chapel Hill (Town) and interviewed supervisors and waste collection staff. Residential, yard waste, scooter truck, and commercial routes and collection practices were observed. SCS conducted these field observations and interviews for the purpose of providing the Town with recommendations to improve solid waste collection efficiencies while maintaining the ongoing high level of customer service Town residents appreciate and expect.

4.1 OBSERVATIONS AND RECOMMENDATIONS FOR IMPROVED COLLECTION EFFICIENCY

4.1.1 Residential Collections

4.1.1.1 Containers

During field observations, it was noted that some residents do not have the standard Town issued trash carts, and instead use standard trash cans or leave non-containerized bags on the curb. Furthermore, some residents use cans that cannot be mechanically tipped to manage excess waste volumes in addition to the town issued carts. Management of these variable containers and waste placement methods by Town collections staff introduces inherent inefficiencies in the collections process. Non-standard cans often do not have wheels or handles which cause collection staff to lift heavy objects and prevent the use of mechanized cart tippers. The physical management of overweight cans and odd containers creates delays and subjects collections personnel to an increased risk of injury. Requiring residents to use the town issued carts will allow the carts to be mechanically tipped rather than physically lifted by Town employees, increasing efficiency and reducing the amount of physical labor required.

The Town could realize increased efficiency with residential waste collection by collecting only waste placed in the Town-issued cart. However, as with the current practices, a special exemption for appropriate circumstances may be issued to qualifying households. Residents who do not put their waste in a Town-issued cart would face the consequence of not having their waste collected, which means having to store it for another week or transporting it to a disposal site themselves. With the closing of the Orange County landfill, improving overall collection efficiency becomes a more relevant factor when considering the additional off-route time necessary to transport collected waste a longer distance to another public or private landfill or transfer station as discussed in Sections 6 and 10.

The Town ordinances, Chapter 8, Sections I and II describe regulated collection and disposal policies including receptacle policies; however, our assessment noted adherence to many of these policies are loosely enforced. According to the Town ordinance, a 65-gallon cart, provided by the Town at no charge, is available to each residence by request. A public notice directing those residents needing a cart to request one, and an audit/inventory conducted by the collections staff during their regular collections routes would identify other residents needing a Town-issued cart. Standardizing the collection carts would not only promote collection efficiencies, it would

likewise assist in a transition to automated collections as discussed in other sections of this report.

Furthermore, the Town should consider revising the Town ordinance to limit the number of carts placed by individual residents for weekly collection, or establish a fee for collection from additional carts. Section 8 of this report, an evaluation of PAYT practices, presents several options which may assist the SWSD in managing and accounting for waste volumes that exceed the Town-issued cart capacity. These include:

- Implementing a supplemental PAYT bag or tag program, thus allowing excess waste to be placed in a town-issued bag or a resident-provided bag/can tagged with a Town-issued sticker, each purchased by the resident.

- Implementing a PAYT variable or subscribed can program. For those residents requiring additional weekly disposal capacity, the resident could request a larger cart (e.g., 95 gallon) and would be assessed a requisite annual fee. A discussion of recommended fees is presented in Section 8.

4.1.1.2 Exemptions

As discussed in Section 2, Town collections staff currently service more than 900 households claiming an exemption from the standard curbside, cart collections service. According to the Town ordinance, these exemptions are offered to provide service to customers with disabilities and other physical limitations, age-related ability, and challenging physical property characteristics. Town staff indicated that exemptions are ideally reviewed annually; however, this review has not been performed in some time.

The waste from exempt households is collected with either a rear loader or the scooter truck (i.e., modified pick-up truck), depending on the household container's distance from the main road. Current and future routing processes cannot incorporate the exemptions since they require a special vehicle or manual service. Proper routing for collection vehicles reduces travel time between stops; however, the exemptions are located in all geographic areas of the Town which will not benefit from reduced travel time between stops. Hence, servicing such a large number of exemptions creates vast inefficiencies in the standard weekly collections.

Some of these exemptions were established several years ago and should be reexamined to assess if the case for an exemption still applies to the current resident's situation. Some exempt collection households are close to the main streets, and these exemptions should be collected with the rear loader trucks if the container is within a reasonable walking distance (i.e., approximately 20 yards).

The number of exemptions offered by the Town appears large when compared to the number of exemptions offered by the County for recycling collection. The County manages collection of recyclables for 18,400 households in the combined areas of the Town as well as the unincorporated areas of the County and the Towns of Carrboro and Hillsborough. The County has just 115 exemptions for special recycling collection services. Over 7% of the Town's households receive an exemption for waste collection but less than 1% of the County's

households receive an exemption for recycling collection. It is recommended that the Town review exemptions on an annual basis and require a verification of need such as a medical statement or handicapped tag.

4.1.1.3 Private Driveways

Numerous households along the residential collection routes maintain lengthy and spatially constrained private driveways, which limit access to the rear loader collection vehicles. Currently, these households with private drives are not required to position their carts curbside along the main roadway for collections by rear loader vehicles. Thus, the rear loader vehicles do not collect containers from residences that can only be accessed by a private drive. The solid waste from these households is collected by scooter trucks, which creates inherent inefficiencies in providing this level of service because these households cannot be incorporated into the existing waste collection route that services their geographic area. The scooter trucks represent a much smaller capacity and require multiple daily trips (usually three to four times per day) to the nearest rear loader. The inefficiencies of this service will be compounded with the closure of the Orange County Landfill and proposed short-term solution to direct haul collected waste to a transfer station.

Households currently receiving private driveway service should be evaluated along with the households claiming a collection exemption to further determine the necessity to provide private driveway service on a case-by-case basis. Those households that are physically capable (i.e., do not qualify for a medical or age exemption) of positioning their waste carts curbside for routine, scheduled collection with the rear loader collection vehicles, and in accordance with currently established routes and collection days, should be required to bring their cart curbside for collection. Residents who do not qualify for an exemption and choose not to put their waste-filled cart at the end of their driveway would not have their waste collected by the Town. Alternatively, the Town may assess a private driveway service fee (recommended $16.50 per month), similar to the PAYT fee as described in Section 8, for those customers who would choose a driveway service rather than placing their waste carts curbside for regular collection.

4.1.1.4 Limited Residential Routing Evaluation

Along with this collections system evaluation, SCS completed a limited review of the Town's current residential collections routes for the purpose of making general recommendations to improve existing routing configurations and collections efficiencies. SCS and SWSD staff concur that a formal, technical routing study, utilizing GIS data and industry-specific software is particularly warranted at this time to support system-wide modifications with the closing of the Orange County Landfill and need to transport collected wastes elsewhere. A routing study for the Town is estimated to cost about $45,000 to $55,000. However, based on a review of the Town's existing routing schematics, interviews with route residential and commercial collections supervisors, and observations of select residential routes, SCS recognized a number of recommendations to improve collections while the Town considers a technical routing study.

Throughout the history of Town solid waste collections operations, SCS understands that a technical routing study has not been performed to date. The existing routing configurations have been developed over time through general trial and error while hauling residential MSW waste to

the Orange County Landfill. A general description of each of the historical fourteen (14) residential collections routes is provided in Section 2. As described, these collections routes have historically been serviced by seven (7) dedicated crews and vehicles. SCS's initial evaluation of the routing configurations on each of the two (2) residential MSW collection days recognized that these routes are equally distributed throughout the town.

Considering budget authorizations for FY 2012-13, the SWSD was funded for full-time collections staff commensurate with six (6) routes. Based on the Town's budget data, our limited review of collection routing data, and experience with collections in other municipalities, considerations for general routing recommendations to provide sufficient collection capacity while making a transition to an alternate disposal facility with the closure of the Orange County landfill are discussed below:

- Approve a budget amendment for FY 2012-2013 to fund the historical 2-day per week collection schedule and provide appropriate weekly collection capacity. The Town would likely fill the currently vacant full-time positions and cease using temporary labor to accomplish the seven (7) route configuration (the Town maintains sufficient collection vehicles and equipment and 7 routes are currently dispatched despite the budget allocation and funding). This fiscal impact of this routing configuration is presented in Section 6.

- Alternatively, transition to a 3-day per week MSW collection schedule. The SWSD would eliminate a route and maintain the budgeted six (6) residential collection crews servicing consolidated and reconfigured routes. Yard waste collection would continue on the current 2-day per week schedule. This fiscal impact of this routing modification is presented in Section 6.

- Consolidate collection routes to be located in the general vicinity of each other to promote efficiencies while transitioning end routing from the Orange County Landfill to a transfer station. Rather than equally distributing the residential routes throughout the Town on the designated collection day, SCS recommends that the Town should be divided into two (2) halves, so that there are an equal number of routes in the northern half of town versus the southern half of town. Crews would then collect from half of the town on one (1) collection day and the alternate half on the second collection day.

Modifying the routes in this manner would allow supervisors to adjust personnel and equipment resources more efficiently to react to breakdowns, potential overweighting, and other routine problems anticipated during collections. With the routes coordinated in closer proximity to one another, it would be easier for the Town to re-direct resources from adjoining routes to cover any deficiencies caused by these potential collections issues. Similarly, the individual routes may be designed to terminate at a mutual end point, such that the vehicles may potentially caravan when direct hauling out-of-county to a transfer station. By pairing or caravanning, drivers and crews may efficiently respond to potential break-downs during this transport.

4.1.1.5 Customer Service System

According to interviews with supervisors and other SWSD staff, SCS understands SWSD does not operate with a formal customer service system. Historically, customer calls, comments, and complaints are taken by phone, written down on paper, and then passed to the collections crews. SWSD and the Town do not have a means to maintain electronic record of calls and Town responses.

SCS is familiar with several readily available customer service software systems. Several are tailored to solid waste management services, and in particular, Mobile 311 is designed for municipal applications. Mobile 311 utilizes standard mobile devices (i.e., cell phones, text messaging) to quickly relay information from the office to the field employees, while also maintaining electronic record of correspondence. This software can help expedite the Town's response to routing issues, special requests, exemptions, and access problems, while assisting SWSD management track the division's response. Furthermore, the software can also help streamline bulky and yard waste collection by allowing the drivers to generate work orders and more efficiently communicate with the knuckleboom and flatbed truck equipment operators, while more accurately and expeditiously initiating billing functions.

The Mobile 311 system is equipped with a GPS tracking system that relays GPS coordinates to a central electronic locator map. Management may use the system to track the location of each vehicle outfitted with the technology in order to respond quickly and efficiently to route and vehicle problems, special collections requests, and monitor driver performance. Furthermore, the electronic data is valuable when analyzing collections routes.

The cost for Mobile 311 is $60 per month per field user excluding the purchase cost of a smartphone and monthly mobile phone contract. SCS estimates a total monthly cost of approximately $2,700, assuming $100 per month for each mobile phone contract, based on 17 users under the current residential and commercial collection configuration. There is a one-time services setup fee of $500 and training is available for $125/hour. There may be some additional administrative and program costs for such a program, which is beyond the scope of this study, but it is believed to be negligible compared to the monthly operational costs. If the Town wishes to add additional users, the price costs would adjust accordingly.

- Seven (7) residential collection vehicles;
- Two (2) commercial collection vehicles;
- One (1) vehicle for bulky waste;
- One (1) knuckleboom truck;
- Two (2) scooter trucks;
- Two (2) supervisors;
- One (1) inspector; and,
- One (1) backup.

4.1.2 Commercial

Similar to SCS's residential collections system observations, SCS evaluated the Town's commercial collections systems for both commercial-business and commercial-multi-family

customers. Commercial collections customers also include numerous public entities: schools, Town offices, parks and recreation, etc. Commercial service customers are generally described as an entity which maintains one or more bulk solid waste containers (i.e., dumpster) collected weekly by the Town front loader vehicles. The Town provides service to these customers 5 days per week as requested in accordance with a published fee schedule. Collections have been historically managed daily among two (2) separate routes with a collection vehicle assigned to each route. Like the residential collections, these routes have been established over time without the benefit of a technical routing evaluation. In addition to these customers with bulk containers, commercial collections include approximately 16 customers that use residential roll-carts serviced by the Town's rear loader collection vehicles.

4.1.2.1 Routing Software

Several software companies offer routing services and software that could benefit the residential and commercial collections routes. A technical routing evaluation, utilizing GIS data and route modeling iterations would promote increased collection efficiencies, lower collections costs, and would likely improve customer satisfaction. The goal of such evaluation would be to maximize collection volumes while compressing on-route total traveling distances. Furthermore routing software will allow new customers to be easily integrated into the existing routes. The estimated cost of commercial routing software is about $15,000 to $25,000 for the software. Periodic updates are required as the software is enhanced or if the service area changes substantially. It is expected that staff time to maintain the routing software will be minimal.

4.1.2.2 Collections Route Start Time

SCS observed that each of the two (2) commercial collections routes initiated their route at 5:30 a.m. The route drivers typically work a 5 to 6 hour day and make two (2) trips to the Orange County Landfill. The commercial route drivers indicated that the current collections schedule is impacted by daily routine traffic congestion, primarily in the business district. Starting the commercial collection routes earlier in the day, and targeting the downtown business district first, would allow vehicles to collect containers more efficiently in these urban areas where traffic and parked vehicles can cause delays later in the day. Furthermore, an earlier start would benefit the driver's direct hauling a longer distance to a transfer station by mitigating congestion delays.

Chapel Hill Code of Ordinances, Chapter 11, Article 3, Section 11-40(o) provides a noise exemption for sanitation and recycling services operating between the hours of 5:30 a.m. and 11:00 p.m. with approval by the Town Manager. Authorizing an earlier start time would require modification of the Town ordinance and approval from the Town Manager.

The downtown business district is a concentrated commercial area subject to minimal residential noise impact. Based on several commercial collection noise studies for other SCS clients involving similar waste containers and collection vehicles, SCS has concluded that the greatest noise level generated during a tipping event is caused by the shifting and dumping of the waste in the container and not the vehicle or raising of the container itself. In general, the results of studies near active commercial areas determined that the noise generated during a collection event is not much greater than background from traffic and other commercial activity (i.e.,

deliveries, emergency vehicles, etc.). The results of these analyses would support a petition to modify the Town ordinance in concentrated commercial areas to accommodate an earlier collection time. SCS would note however, that containers at multi-family buildings or near residential areas should be avoided early in the morning in order to reduce noise complaints.

4.1.2.3 Pickup Days

As previously stated, the Town currently provides commercial collection services 5 days per week. A cursory review of Town commercial collection data determined that the collection locations and frequency is generally equally distributed across the 5-day collection schedule, resulting in the Town servicing between 70 and 80 customers each day. Furthermore, the analysis identified only approximately 40 customers receiving collections 3 to 5 days per week. SCS recommends that Town SWSD staff work directly with these select customers to accurately evaluate their required collection frequency. In addition, collaborating on waste reduction strategies for these customers would likely reduce their needed collection frequency, resulting in fewer trips, and adding to the commercial collection crew's available off-route travel time. This targeted analysis would help these customers maximize container volume, improve Town collection efficiency, and reduce on-route collections travel time. SCS recognizes that such transition would involve customer outreach to the impacted customers. With fewer collection events, SCS anticipates the collection staff may recognize sufficient gains in off-route time to enable two (2) trips to a targeted further disposal facility; however, the Town would also lose revenue associated with the reduction in collection events.

A formal routing analysis and maximizing container capacities may result in further routing consolidation, perhaps even supporting a 4-day collection schedule. By consolidating collection days, the waste containers would maximize their volume capacity, collection vehicles may more efficiently achieve load capacity along fewer trips to these customers, and the Town would recognize a savings in fuel and equipment usage charges attributed to this extra collection day. However, when consolidating collection days and maximizing container capacities, these analyses must take into consideration the need for contingent waste capacity needed to manage excess volume in the event Town collection vehicles break down, or during peak disposal periods coinciding with the school calendar.

4.1.2.4 Customer Service System

Similar to residential waste collection, the Town commercial collections system could benefit from a customer service system such as Mobile 311 described above in Section 4.1.1.5.

4.1.2.5 Reconfiguration of Commercial Collection Services

With this comprehensive review of the Town's solid waste collection and disposal services, SCS prepared a detailed financial analysis of the existing commercial collection services and the projected impacts of specific program modifications to these services to include:

- Adjusting the commercial collection fee structure;
- Eliminating commercial-private sector collection service while retaining commercial-multi-family collections using Town resources; and,

- Eliminating Town commercial collection services entirely.

Using the Town's FY 2012-13 budget, SWSD staff assignments, waste disposal data, and other Town records, SCS appropriately allocated SWSD costs between residential and commercial services. With these allocated costs, SCS employed the pro forma scenario modeling to assess the projected impacts to the Town budget for each of the scenarios listed above. A detailed discussion of this analysis, results, and recommendations is presented in Appendix A.

4.1.2.6 Grease Management

The Town maintains a "grease corral" downtown for restaurants and other food service providers to dispose of used grease. Collection from the grease corral is provided by third party collection vendors contracted by the restaurants. Revenues from the sale of grease is returned to the restaurant and not presently shared with the Town. Collection vendors are to provide scheduled cleaning maintenance; however this maintenance is often insufficient or on an irregular schedule to sufficiently address the corral's cleaning needs, thus Town staff are often left to perform the cleaning services to avoid environmental hazards and a general public nuisance. Furthermore the inherent turnover of temporary staff presents a challenge to restaurant owners in property training its employees on the use and maintenance of the corral.

To reduce the workload on its staff, avoid environmental risk, and mitigate the potential of this public nuisance, the Town should require that each restaurant manage its own grease through a private grease collection firm at the point of generation and cease operation of the grease corral.

4.1.3 Yard Waste

As described in Section 2, the Town currently provides one-time, weekly, curbside yard waste collections along the 14 established residential collections routes. Dedicated yard waste roll-carts are available for purchase from the Town for $47 each; however, residents may also prepare yard waste for collection per the following methods:

- Rigid container – less than 40 gallons and less than 60 pounds;
- Paper yard waste bags;
- Bundled limbs and twigs, etc. – less than 50 pounds, less than 4 feet in length, and less than 24 inches in diameter; and,
- Loose piles at the curb – brush and twigs less than 3 cubic yards.

The Town takes the collected yard waste to the Orange County Landfill to be mulched and sold to County residents. Orange County charges $25 for a 3 cubic yard scoop of mulch for residents providing their own hauling, and delivers larger volumes of mulch using County resources for a bulk fee equivalent to approximately $10 per cy.

4.1.3.1 Collaborate With UNC for Yard Waste Processing

SCS determined that UNC owns and operates a tub grinder to process storm debris, limbs, brush, and yard waste gathered from around its campus. The resulting mulch is used on campus and off-sets mulch costs otherwise incurred for landscaping. During discussions with UNC staff, SCS understands the UNC tub grinding process is currently operating under an exemption from NCDENR permit conditions, equivalent to a small-scale farm-use exemption. UNC's operations reportedly process an estimated 100 to 200 tons per month, approximately equal to the annual quantity of yard waste collected and disposed from the Town.

During preliminary meetings with UNC staff, SCS understands the UNC process has the capacity to grind (mulch) the Town's yard waste from its residential collection. Furthermore, most recently the UNC process has not generated enough mulch to satisfy landscaping demand and the university was required to purchase mulch. Thus, UNC staff would welcome Town collaboration to meet this demand. These preliminary discussions indicated that the operating footprint of the current UNC operation would likely need to be expanded by moving perimeter fencing to accommodate the projected additional material contributed by the Town. Furthermore, by including the Town's yard waste with their operation, the mulching operation may become subject to NCDENR permitting since it is accepting material generated off-site. However, the university has indicated an interest in considering a partnership with the Town for processing yard waste and is interested in discussing projected volumes and potential processing fees.

4.1.3.2 Containers

Based on field observations, yard waste piles often do not conform to the Town collection rules. Most often, waste collections staff is left to manage non-conforming piles of loose branches and brush by hand which requires a lot of manual labor per collection stop. SCS recommends requiring households to containerize yard waste curbside in the Town provided carts capable of being mechanically tipped by the Town's residential collection, rear loader vehicles. Enforcing this practice would reduce the physical labor required to collect the waste and the possibility of collection-related injuries. Containerizing the yard waste would also greatly reduce the time spent per stop and decrease overall route time. For the purposes of easing the impacts of transition of service, SCS recommends that the Town purchase yard waste collection carts for its residents and factor the cost of providing carts in annual SWSD budget.

Based on recent Orange County solicitation data, the carts are anticipated to cost approximately $50 each. Purchase of 11,500, carts at $50/per cart would cost approximately $575,000. This would add about $0.51/household/month to the collection costs for the additional carts, assuming a 10-year amortization period at 4% interest. Assuming an $18/ton disposal fee for yard waste, the Town could consider charging an additional $1.5 to $2/cart per pickup (or something less if it so chooses) for each additional cart to cover the additional disposal costs. Implementing this change would likely require 6 months to a year to implement, and require public education and notification.

When recognized, the Town does not collect large piles of tree removal debris set out by contractors. The Town should engage in education and public outreach with residents and

contractors to ensure that the contractor hired by the resident for significant yard clearing and tree removal is held responsible for collection. Requiring yard waste containers may mitigate collection system abuse by tree removal contractors.

Similarly, these yard waste containers could also be utilized for food waste if the Town were to implement a program to collect food waste for composting or an anaerobic digestion process as discussed below in Section 4.3.2.

4.1.3.3 Seasonal Loose Leaf Collection

As described in Section 2.0, seasonal loose leaf collection is currently provided by the Town's Streets Division utilizing Town vacuum truck services. These analyses support that such vacuum service is the most efficient means by which the Town should manage the large volume of loose leaves generated during the Fall months. SCS suspects that the projected volume would inundate routine yard waste collection capacity should the Town manage loose leaves using yard waste carts.

In the event the Town decides to implement its own yard waste processing facility for composting, mulching, or other waste conversion technology, the loose leaves may provide marginal value to these operations. By nature of the dried leaves, little organic value is added to any of these processes; however, the material provides bulk.

4.1.3.4 Knuckleboom

The Town's knuckleboom truck is mainly used to collect large piles of brush and branches that are difficult to otherwise collect manually. Currently the Town does not operate a system to identify, in advance of collections, where these bulk piles are located. Most often the rear loader collection truck operator will call the knuckleboom operator to inform them of the location of large yard waste piles along their designated route. This random notification system promotes inherent inefficiencies in bulky collections.

Utilizing a customer service system, on-board communications and tracking system, and GPS system (or any combination thereof) would dramatically improve the Town's efficiencies in scheduling and collecting bulky yard waste piles. Furthermore, these systems would allow the Town to more accurately track and account for bulky collection fees should the Town decide to implement fees for yard waste collection that does not comply with new container requirements. By implementing a mandatory yard waste cart policy, the Town can anticipate that residents will periodically have need for bulk yard waste collection utilizing the knuckleboom truck for which an additional fee may be charged.

4.1.3.5 Re-Education, Notice, and Enforcement of Setout Requirements

Currently the Town setout requirements such as bundling branches/sticks and the 3 cubic yard maximum are not strictly enforced. SCS recommends enhanced public communication and education efforts for the purposes of reiterating and re-educating residents of the Town regarding yard waste set out requirements. With these communication efforts, advance notice of enhanced enforcement when these Town policies are violated may be disseminated to the public.

Furthermore, a requirement to utilize yard waste carts creates a program that is easier for residents to regularly comply with the Town policies.

4.1.4 Bulky Waste Collections

4.1.4.1 Operations Improvements

Bulky wastes and dead animals throughout the Town are collected during the week according to a consistent schedule but on a random route depending on where the bulky waste and dead animals are located. This route is staffed by a single equipment operator and a flatbed truck equipped with a lift gate. The Town maintains a bulky waste fee schedule and requests that Town residents schedule collections accordingly with SWSD. While these practices still occur as scheduled, this bulky waste flatbed truck often drives randomly around the town with no particular route, looking for bulky items that have been left on the curb. When these random items are identified and collected the Town has no means of identifying the customer or assessing for associated collection fees. Understandably, these random collection practices promote inequality among paying and non-paying customers and encourage the continued practice by residents of failing to notify SWSD of bulky collection requests. SCS understands bulky waste collections are further complicated by the high ratio and transient nature of the university population.

SCS recognizes that significant accountability improvements can be made in identifying, scheduling, tracking and billing for bulky waste collections. Furthermore, customers who set out bulky items randomly without a scheduled appointment and/or posting payment should be assessed a fine or penalty. More efficient operations would result in the flatbed truck and operator deploying fewer days per week, thus saving wages, fuel, and equipment usage charges. Electronic reporting systems, (i.e., GPS system and on-board reporting system) as described in the section above, would enable SWSD staff to quickly locate bulky items at curbside, report these locations to a central dispatch, schedule efficient collections routes accordingly, assess billing and accountability, and track resulting collections.

Billing should ideally be performed and collected prior to scheduled collection; however, the on-board reporting system would provide the Town better resources to close these accounting gaps. Once non-scheduled bulky waste is identified, the Town may quickly identify it, provide a maximum of 1 week to bill and collect before proceeding with collection in-lieu of receiving payment. The account can then be turned over to collections. If the responsible party cannot be determined the Town may elect to bill the property owner. However the Town should maintain a budget to account for costs associated with illegal dumping and delinquent collections.

By sponsoring designated bulk collection days corresponding with the university calendar (e.g., move-in and move-out) and offered at a discount rate or even free, the Town may better staff and respond to these times of typically higher bulky waste volume, thus thwarting associated illegal dumping and billing issues.

4.2 REVIEW OF TOWN SOLID WASTE ORDINANCES

Town ordinances concerning the management of its solid waste collection and disposal are promulgated in the Chapel Hill, North Carolina, Code of Ordinances, Chapter 8: Garbage, Trash, and Refuse. Article I provides the general code. Article II presents regulations governing collection and disposal practices, and Article III provides landfill regulations pursuant to participation with the Orange County Landfill. SCS's analysis of current collection practices and policies included a review of these Town ordinances and the impacts recommended solid waste program modifications may have on the Town code and vice versa.

4.2.1 Article I - General Solid Waste Code

With review of this article, the Town would potentially need to amend Section 8-5, "Garbage and Household Waste Cans". As currently authored, this code section:

- Does not limit the number of waste cans residents may set out;
- Specifies a 32-gallon can or less or provides the option to use the Town-issued carts; and,
- Does not limit the variability of can configuration (i.e., metal, plastic, varying height, width, etc.).

In the event the Town decides to prescribe a standard Town cart to promote collection efficiency using its current labor and equipment resources or implement automated collections, this section would need to be revised to specify these waste cart requirements.

Furthermore, Section 8-5 describes the Town's curbside collection exemption policy to include age and health-related exemptions. Based on this analysis, and the more than 900 exemptions granted by the Town, this article warrants revision to include a routine annual review/renewal of exemptions and ongoing proof supporting the reasons for exemption. Likewise the exemption policy as written in the code does not address exemptions currently afforded to households with challenging access (e.g., long driveways, tight turns, etc.).

Section 8-6, "Additional Garbage Storage Facilities" allows residents to set out additional waste without any definitive requirements. If the Town decides to implement a prescribed Town cart policy, the limits of this requirement would be better described within this code section. Furthermore, if the Town decides to implement a modified PAYT program to manage excess waste placed curbside for collection, the prescribed options for these PAYT practices may be defined in this code section.

4.2.2 Article II - Regulations for Collection and Disposal

4.2.2.1 Section 8-21: Definitions

A review of Section 8-21, "Definitions", concluded that the definitions of "Household Refuse" (i), "Refuse Receptacles" (m), and Yard Waste Container" (r) would require revisions of the described waste containers should the Town elect to implement a prescribed waste cart policy for

typical collections or implementing automated collection. In each of these current definitions, the waste cart is defined as a 32-gallon can of varying specifications or a Town-issued cart. Furthermore the yard waste container, as defined, is limited to a 40-gallon can; however, this Study has recommended requiring a Town-issued, 95-gallon can for yard waste collection.

4.2.2.2 Section 8-24.1: Brush Disposal

A review of Section 8-24.1, "Brush Disposal", concluded that item (b) currently provides well defined limits to the manner in which yard waste materials are to be prepared for collection; however, no restriction is provided for the quantity of material placed curbside for collection. Establishing a weekly maximum quantity for curbside collection would promote improved route efficiencies. Furthermore, this analysis has recommended limiting the Town's management of loose piles by requiring a Town-issued yard waste cart. If agreed, the inclusion of the Town-issued cart and exclusion of loose piles may be addressed in this Section.

4.2.2.3 Section 8-24.3: Limitations on Service

A review of Section 8-24.3, "Limitations on Service", concluded that item (d) does not sufficiently exclude contractor-generated yard waste from applicability to curbside collection. If the Town wishes to enforce potential abuse of the Town-provided service by commercial, private-sector contractors, the limitations as described in this section must be better defined.

4.2.2.4 Commercial Collections

Contingent upon the Town's decisions regarding commercial collections and potential outsourcing, or privatization of these services or portion thereof, numerous code sections relevant to the management and disposal of bulk containers would warrant revisions and/or deletion.

4.2.2.5 Section 8-35: Bulk Containers for Multiple Residential Units

Chapel Hill code currently requires bulk containers (i.e., commercial collection) for new multi-family properties consisting of six (6) or more units per lot, unless a special waiver is granted by the Town Manager or Town Council. Waivers are considered for units constructed before 1973 and for properties where bulk service would create a public safety or health concern. Through this Study, SCS recognized this article is particularly contentious based on the Town requirement of a prescribed service level (i.e., bulk collection versus roll-cart collection). A separate analysis further evaluating such prescribed service level is provided in Appendix B. Contingent on decisions by the Town Manager or Town Council, this article may warrant revision.

4.3 IMPLEMENTING WASTE COLLECTION TECHNOLOGIES

The Town could benefit from implementing the following waste collection technologies described below. Our assessment includes the cost for deployment of these technologies, the resulting data that can be obtained from their use, and the program enhancements that can be realized.

4.3.1 Transition to Fully-Automated Collections

The Town currently employs semi-automated (i.e., hydraulic cart tippers) collection along each of its residential waste collection routes. A driver plus two (2) Town employees are used on each of its waste collection routes. Waste collection carts are placed on the hydraulic cart tippers to empty the cart's waste into the collection vehicle and then the Town employee returns the cart back to the curb. A benefit of semi-automated collection over manual collection is improved worker safety and decrease in workers compensation costs.

Fully-automated collection vehicles use a single driver and a collection vehicle outfitted with an arm capable of picking up the waste cart and emptying its contents into the vehicle. One of the benefits of automated collection is a decrease in personnel necessary to collect the waste. Fully-automated collection requires a single driver that can collect from 800 to 1,000 households per day. Semi-automated collection requires a crew of three (a driver and two loaders) to service between 600 and 800 households per day. Variables that affect the additional number of households gained by full automation include: density of residences, distance to landfill, and capacity of the collection vehicle. When transitioning to full-automation, most municipalities must re-evaluate collections routes as the automated vehicle is limited to servicing only one side of the street at a time, most often from the right side of the vehicle, thus requiring predominant right-hand turn routing.

According to "*The Benchmarking of Residential Solid Waste Collection Services: FY 2008 Report"* by SWANA, semi-automated collection practices typically decreases worker injuries but semi-automation does not significantly improve the number of households served per hour. SWANA concluded that the process of hooking a cart to the cart tippers and executing the automated tipping function takes some time. Exhibit 4-1 below depicts the average number of residential units served by each standard waste collection method.

Exhibit 4-1. Number of Residential Units Serviced Per Hour by Collection Method

Collection Method	No. of Residential Units Served per Hour
Fully-Automated	139
Semi-Automated	118
Manual	136
Average for all Methods	132

Advantages and disadvantages between semi- and fully-automated collection systems are presented in Exhibit 4-2.

Exhibit 4-2. Advantages and Disadvantages Associated With Semi-Automated and Fully-Automated Collection

Collection Method	Advantages	Disadvantages
Fully-Automated	• Maximize productivity • Significantly reduce worker injuries • Municipality can match the productivity of the private sector	• Problems with on-street parking • Problems with one-way streets • Problems with low wires • Set out must be limited • New rules and requirements for customers • Specialized driver training to adjust to larger collection vehicles and right-hand driving. • Cost of replacement trucks is higher • More costly and challenging vehicle maintenance
Semi-Automated	• On-street parking and low wires are not a problem • Allows for flexibility and allows collection personnel to still manually load • Existing fleet can be retrofitted • Cost of trucks and maintenance lower	• Workers exposure to injuries still exist • Not a large productivity gain

Observations of the Towns waste collection observations indicate that fully-automated waste collection could be implemented in many of the currently established routes. Exhibit 4-3 presents an assessment of each collection route's potential for utilizing fully-automated waste collection vehicles. This assessment is based jointly on SCS's observations and the Town's judgment through interviews with a route supervisor. The Town should conduct a routing study that incorporates the ability to collect using full automation. Routes that do not support automation 100% can be split so that the portion that can be automated is combined into another route. Households that do not support automation can be aggregated into separate routes.

For applicable solid waste collection and disposal option scenarios, SCS's pro forma modeling tool includes life-cycle cost analysis of implementing a phased transition to automated collections along select residential collection routes, beginning with a pilot-phase study of a few routes in FY 2014-15. These analyses depict the fiscal impacts over a 30-year period of both a partial transition and full transition to automated collection. These analyses are specifically discussed in Sections 6 and 10, direct hauling of Town solid waste to a transfer station and a landfill respectively. For each of the other scenarios, the pro forma modeling tool allows the capability to quickly forecast the financial impacts of implementing automated collection along with the programmatic changes relevant to the specific waste management scenario being considered.

Exhibit 4-3. Residential Route Potential for Fully-Automated Waste Collection

Route		Percentage of Route that Could Support Fully-Automated Collections
204	Monday	100%
	Tuesday	100%
207	Monday	100%
	Tuesday	100%
208	Monday	0%
	Tuesday	100%
209	Monday	80%
	Tuesday	75%
210	Monday	75%
	Tuesday	75%
216	Monday	100%
	Tuesday	100%
232	Monday	100%
	Tuesday	100%

Planning efforts and preliminary action items that will be necessary to enable implementation of a pilot-phase program to transition to automated collections for even a single residential route are noted below. SCS believes a realistic timeframe to initiate the pilot-phase program is two years and the timeframe for implementation of a full automation program is four years.

- The existing routes will need to be evaluated and the most appropriate route will need to be identified and selected;
- A new automated collection vehicle will need to be purchased and a maintenance plan will need to be developed;
- Select SWSD staff will need to be trained on the proper operation of the new automated collection vehicle;
- Each household within the route will need to be equipped with the proper Town-issued cart; and,
- An outreach and education campaign will need to commence in order to engage residents on the goals and protocols associated with the pilot-phase program.

4.3.2 Organics Diversion (Food Waste)

As described in Section 2, the Town currently provides for separate collection of residential waste (i.e., MSW), yard waste, and recyclables. The SWSD staff and several Town residents have expressed an interest in developing an organics diversion program in effort to improve performance against the Towns waste reduction goals, and to lower MSW volume and related cost. Organics diversion programs that include food waste from residential and commercial customers have been implemented by various communities, businesses, and institutional entities

(e.g., universities and correctional facilities) throughout the United States. Of particular note, the University of North Carolina–Chapel Hill (UNC) operates a robust organics diversion program on its campus with cooperation from Orange County and Brooks Contractors.

4.3.2.1 Summary of Organics Diversion Process

By design, organics diversion programs reduce the quantity of waste that is disposed in landfills at the source of generation, and generally makes beneficial use of source separated organics through composting or anaerobic digestion. The end product of composting is a humus-like material that can be used as a soil amendment. The end product of anaerobic digestion is methane gas and residual solids that can be further processed through composting and used as a soil amendment. Methane gas generated from anaerobic digestion processes typically is a medium BTU gas (500 MMBTU per cubic foot) and can be used to generate electricity (vendors have quoted SCS 200 kWh/ton), used as a fuel substitute in various other combustion processes (e.g., boilers), or further treated to produce a high-BTU fuel product that can be either directly injected into natural gas pipelines or used as an alternative vehicle fuel (compressed natural gas or liquefied natural gas).

4.3.2.2 Estimated Material Volume

According to the United States Environmental Protection Agency (US EPA), approximately 14% of the total municipal waste stream consists of food waste[3]. The 2010 Waste Composition Study[4] performed for Orange County, which included Chapel Hill, indicated that food waste in Town represented 26% of the total waste stream. According to annual recycling data gathered by UNC, during the 2010-11 reporting year, their organics diversion program recovered 538 tons of organic materials for composting at Brooks Contractors. This represents 17% of the 37% recycling achievement.

Various studies[5,6] indicate that per household generation of food waste ranges from 5 to 10 pounds per household per month. Using these two data points, Exhibit 4-4 provides an estimate of the total potential food waste generation and projected recovery from the Town's residential waste stream assuming an average 50% participation (or setout) rate. The exhibit also provides an estimate of the organics that might be captured from the commercial waste stream as well; however, for the purpose of this analysis, only the curbside residential customers are considered.

3 U. S. Environmental Protection Agency, http://www.epa.gov/osw/conserve/materials/organics/food/fd-basic.htm
4 SCS Engineers, Orange County Waste Composition Study, Summary of April 2010 Results, Prepared for Solid Waste Management Department, Orange County, North Carolina, June 15, 2010.
5 Econservation Institute, Best Management Practices in Food Scrap Programs, Prepared for U. S. EPA Region 5.
6 SWANA Applied Research Foundation, Curbside Residential Food Waste, Research Memorandum, December 2008.

Exhibit 4-4. Organics Diversion Calculation, Town of Chapel Hill

Calculation Methodology, Town of Chapel Hill, NC Organics Diversion Scenario						
Residential						
Method No. 1 - Based on Waste Composition						
			Food Waste %			
Residential Waste	6500	tons/year	26%		1,690	tons/year
Method No. 2 - Based on Per Household Generation						
Low	5	lbs/HH/week	11,500	Households	1,495	tons/year
High	10	lbs/HH/week	11,500	Households	2,990	tons/year
Potential food waste generation: 1495-2990 tons/year						
For Pro Forma (only include residential)						
	8	lbs/HH/week	11500	Households	2,392	tons/year
				Capture rate	50%	
					1,200	tons/year
Commercial (potential additional recovery)						
	8,590	tons	26.00%		2,233	tons
				Capture rate	25%	
					600	tons/year

4.3.2.3 Key Elements of an Organics Diversion Program

Organics diversion programs commonly involve the following elements:

- **Educational Programs.** As with other recycling efforts, an effective separate food waste organics collection program, whether residential and/or commercial, involves significant public education and communication. If the Town were to elect to implement curbside collection of food wastes, significant public education would be needed to communicate the objectives, schedule, and procedures for storing and collecting this waste stream so as to not create health concerns or nuisances such as odors, insects, or rodents. The Town has experience with public education programs associated with its existing yard waste and recycling programs, and there are resources available from communities which have implemented separate organics diversion programs.

- **Collection.** Typically, residential and/or commercial food waste needs to be collected separately from the other waste streams, although yard waste and food waste collection can sometimes be combined. For example, the City of Toronto has recently implemented a program that collects yard waste and food waste together. The additional costs resulting from the separate curbside collection of food waste is one of the major barriers to implementing a residential organics diversion program. Additional collection costs would include new collection vehicles (amortized costs,

maintenance and repair, and fuel), additional collection staff, and collection carts/bins. The decision on the configuration of the collection system is a function of the location (i.e., travel distance) and requirements of the organics processing facility.

Published information on the cost for separate curbside collection of organics varies widely. A report to EPA Region 5 indicated that collection program rates depended on whether the fees charged include processing fees, whether the community has implemented a PAYT program, whether the program is mandatory, and whether other charges are included in the fee to fund other activities[7]. The EPA further reported:

- The average rate "charged" to households for organics collection, including food and yard waste was $7.70 per month per household ($/month/HH);
- reported costs ranged from $7.50 to $9.95/month/HH); and,
- The average "cost to provide" the service was reported to be $5.40/month/HH.

SCS also reviewed recent published rates from Waste Management, Inc. for separate collection of organics in King County, Washington (the Seattle area).

- The rates varied from $10.80/month/HH to $12.90/month/HH depending on the size of the collection cart (35 to 96 gallon carts, once per week pickup).

To confirm these cost ranges, SCS prepared a conceptual level cost estimate for the Town of Chapel Hill implementing a separate organics collection program. The estimate is presented in Exhibit 4-5, and confirms that a $6.00/month/HH budgetary cost estimate would be appropriate for the Town providing once per week organics collection in addition to the other collection services currently provided. This estimate does not include processing/treatment costs, or additional costs for transport of the waste to a remote processing facility.

While SCS recognizes innumerable scenarios exist pursuant to configuring collections staffing, routing, and equipment to implement a Town-operated organics diversion program, the following analysis was developed as just one example. SCS estimated that running six trucks, twice per week to the Dean Brooks Farm facility, which is approximately 39 miles one-way from Chapel Hill, would cost close to $120,000 per year in additional operation, maintenance, and fuel costs[8]. If labor were to be included as well, we estimate additional costs of close to $38,000 per year would result, assuming one driver at $26/hr.; however, this cost probably should not be considered, since it is already built into the $6.00/month/HH collection costs.

7 Econservation Institute, Best Management Practices in Food Scrap Programs, Prepared for U. S. EPA Region 5. Undated.

8 Assumes: Fuel price = $2.91/gallon diesel, Gas mileage = 3 mi/gal, O&M = $1.42/mi, 78 mile roundtrip, total trip time, including tipping of 140 minutes (travel time per Google maps, and 20 minutes tipping allowance), 12 trips per week or 624 trips per year.

Exhibit 4-5. Organics Diversion Collection Estimate for the Town of Chapel Hill

Trucks			
No. of vehicles		7	(6 operational, one spare)
Price per vehicle	$	230,000	(conservative budget)
Subtotal, vehicles	$	1,610,000	(six active, one spare)
Amortized, trucks, 7 years, 4%		**$268,000**	
Staffing			
No. Drivers		6	drivers
Annual Salary (fully loaded)	$	54,000	/year/driver
Annual Staffing Costs	$	324,000	/year/driver
Supervisor	$	64,803	/year
Total Staffing	**$**	**388,803**	/year
Maintenance, Repair, & Fuel			
Fuel	$	7,589	/truck/year (based on current statistics)
M&R	$	12,281	/truck/year (based on current statistics)
Total Fuel+M&R	$	19,870	/truck/year
Allocation		40%	assumes current yard waste is 40% of the costs incurred with current vehicles
Allocate to Organics Diversion	$	8,000	/truck/year
No. trucks	$	6	
Total M&R + Fuel	**$**	**48,000**	**/year**
Carts			
11,500 HH		$ 50.00	/cart $ 575,000
Amortized, Carts, 7 years, 4%		**$96,000**	**/year**
Annual Allocated Costs			
Staff	$	388,803	/year
Amortized vehicles	$	268,000	/year
Amortized carts	$	96,000	/year
M&R	$	48,000	/year
Subtotal	$	800,803	/year
Admin & Support, 5%	$	40,040	
Totals	$	840,843	/year
No. of Households		11,500	
Totals	**$**	**6.09**	**/month/HH**

Exhibit 4-6. Type III and IV Compost Facilities Within 60 Miles of Chapel Hill, NC

Compost Waste Type	Permit Name	Address	One-way Distance from Chapel Hill	Travel Time (Min)	Municipal/ Commercial/ Institutional
Type IV	McGill Environmental Systems	634 Christian Chapel Church Road, New Hill	28	46	Commercial
Type III	Sanford, City Of	601 N. 5th Street, Sanford	35	52	Municipal
Type III	Dean Brooks Farm	1193 Beal Road, Goldston	39	60	Commercial
Type III	Novozymes Of North America	445 Old Smith Farm Road, Franklinton	46.1	66	Commercial
Type III	NC Zoological Park	4401 Zoo Parkway, Asheboro	59	80	Institutional

(1) Type 1 facilities may receive yard and garden waste, silvicultural waste, untreated and unpainted wood waste or any combination thereof.

(2) Type 2 facilities may receive pre-consumer meat-free food processing waste, vegetative agricultural waste, source separated paper or other source separated specialty wastes, which are low in pathogens and physical contaminants. Waste acceptable for a Type 1 facility may be composted at a Type 2

(3) Type 3 facilities may receive manures and other agricultural waste, meat, post consumer-source separated food wastes and other source separated specialty wastes or any combination thereof that are relatively low in physical contaminants, but may have high levels of pathogens. Waste acceptable for a consumer-source separated food wastes and other source separated specialty wastes or any combination thereof that are relatively low in physical contaminants, but may have high levels of pathogens. Waste acceptable for a Type 1 or 2 facility may be composted at a Type 3 facility.

(4) Type 4 facilities may receive mixed municipal solid waste, post collection separated or processed waste, industrial solid waste, non-solid waste sludges functioning as a nutrient source or other similar compostable organic wastes or any combination thereof. Waste acceptable for a Type 1, 2 or 3 facility may be composted at a Type 4 facility.

- **Processing.** The infrastructure in North Carolina and elsewhere for the collection and processing of source separated organics from residential or commercial customers is not mature. A list of Type III and IV compost facilities within 60 miles of the Town, which are permitted to process post-consumer-source separated food wastes, is provided above in Exhibit 4-6. The facilities are owned and operated by various commercial, institutional, and municipal entities.

  SCS contacted Dean Brooks Farms (Brooks Contractors) and requested information regarding the organics collection and processing services they offer, tip fee rates, and the types of organic wastes they accept. They indicated that they are under contract with Orange County to process various source separated organic waste streams. They also indicated that they provide similar services to several locations throughout Chapel Hill. The Dean Brook Farms facility is permitted to process 75,000 tons/year; however they believe that with recent improvements the capacity may be increased to 100,000 tons/year. This past fiscal year they accepted and composted about 62,000 tons (10,000 tons of food waste); therefore, they still have capacity to receive additional material. They indicated that tip fees they charge for organic waste delivered to their facility depend on the type of material (i.e., culled produce and trimmings would be at a lower rate than household mixed compostables or "break room" type waste/ post-consumer waste), but that a nominal tip fee of $24/ton could be assumed for budgeting purposes.

In Sections 12 and 13, a discussion is provided regarding constructing a new regional anaerobic digestion organics processing facility. SCS estimates that tip fees for this type of facility could range between $45 to $100/ton depending on the assumed capacity of the facility, estimated capital and operation and maintenance costs, and offsetting energy revenues. The wide range of tip fees is due to the uncertainty in the documented facility construction and operation costs for such facilities, and the relatively small-scale of the conceptual facility evaluated. These types of facilities are much more capital intensive and complex than compost facilities; however, the amount of land required for anaerobic digestion facilities is generally much less than compost facilities.

4.3.2.4 Financial Analysis

Applying the tip fee differential of $18.50 per ton between the Durham Transfer Station and the reported tip fee at the Dean Brooks Farm Facility (i.e., $42.50 to $24) to the estimated amount of residential organics that could be diverted from the landfill through a curbside collection program (1,200 tons/year), only a projected disposal savings of $22,000 (1,200 tons/year x $18.50/ton) is estimated. However, significant additional collection costs of over $850,000/year (11,500 x $6.00/month/HH) would be required to provide this service to the Town's estimated 11,500 households. Some cost efficiencies could be realized by combining the yard waste and organics collection services; however, even if the costs are reduced by 75%, the projected cost savings would not offset the increased collection costs.

4.3.2.5 Conclusions and Recommendations

The current management approach of disposing of the Town's organic food waste in a Subtitle D landfill is a cost-effective and environmentally sound practice; therefore, implementing a curbside organics collection program is not recommended at this time. However, the Town should continue to evaluate this conclusion in light of future technology and regulatory changes (e.g., bans on disposal of organics in landfills).

4.3.3 Employing Radio Frequency Identification Device Technologies

Radio Frequency Identification Devices (RFIDs) are being used by some municipalities to monitor waste pickup. Waste collection vehicles that are equipped with RFID readers pick up bins or carts marked with RFID tags. The readers then record the exact time and location of each waste collection event allowing a higher degree of monitoring and control of the waste collection process. More sophisticated systems can use RFID technology to relate the weight of the waste collection container with other data such as customer name and address to enhance customer billing and accountability functions.

The cost for the RFID tags can vary depending on the quantity purchased, level of protective housing, and battery life. Waste collection carts can be purchased with an RFID tags embedded for just about $1.00 additional per cart. The cost of retrofitting existing carts without RFID tags is about $10 per cart. SCS understands the Town is currently systematically purchasing carts equipped with RFID tags. These carts are being distributed into the waste collections systems as existing residential carts are replaced due to damage, age, or new customers added to the system.

Since the Town is not planning on charging its residential customers by individual pickup or by the weight of refuse placed in the cart, it seems that the use of RFID technology will have little benefit with billing or customer service since customers typically call to report missed pickups. SCS recommends the Mobile 311 system and its GPS capability would be a better tool for monitoring waste collection progress. However, RFID tags can be useful for inventory maintenance and enforcement. It is recommended for the Town to invest in a RFID reader and software that utilizes the RFID tag to track inventory and distribution of waste collection carts. The software can also be used as an enforcement tool in disputes to assess the rightful user of waste collection carts. SCS does not recommend retro-fitting existing waste carts as the stick-on tags often become detached and the labor to maintain failing tags is an added cost.

4.3.4 On-Board Scales

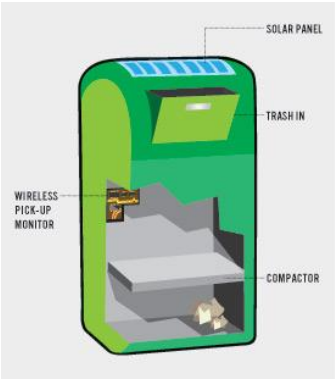
To improve the daily collection activities and accountability of commercial solid waste collection services, the Town may consider on-board scales. An on-board scale system would assist the drivers in monitoring their load to maximize their truck volume, while maintaining their gross weight within NCDOT regulations for transport longer distances to a transfer station. GPS and/or RFID systems would assist route supervisors in scheduling collections, tracking collection events, and responding efficiently to random collection requests.

These systems cost about $30,000 per truck and are used by large private haulers to audit their customers. A single truck can be outfitted with the on-board scale system and rotated through the various collection routes to monitor each business's waste quantities.

4.3.5 Solar Powered Trash Compactor Receptacles for Public Areas

Solar powered trash compactors such as those manufactured by Big Belly Solar have been installed in many towns, cities, and universities to replace traditional, sidewalk trashcans with reported cost and energy saving results. Existing customers of these compactors include: Philadelphia, PA; Albany, NY; Boston, MA; and, Kissimmee, FL. The capacity of the solar compactors is roughly 5 times that of a normal trash can, allowing pickup frequency to be greatly reduced. Installing solar trash compactors downtown and near Town bus stops would potentially reduce collection frequency and related costs in these areas. The Big Belly brand of trash compactors utilizes side-by-side trash and recycling containers which can also improve recycling diversion rates. These solar compactors can relay information back to the Town Operations Center, letting employees know when they have reached maximum capacity and collection is required. The cost for a solar compactor is about $3,700 each. An example of a solar-powered trash compactor is presented in Exhibit 4-7.

Exhibit 4-7. Example of Solar-Powered Trash Compactor



4.3.6 Monitoring and Locking Devices for Downtown Business Waste Compactors

The Town maintains two waste compactors in the downtown area for use by commercial businesses. The annual cost for use of these compactors ranges between $280 to $1,500 per business depending on the volume of waste generated for disposal. The compactors are locked to prevent unauthorized use. Businesses who have registered with the Town to use the waste compactors are provided a key for access. The Town contracts with Waste Industries for the weekly collection of the compactors.

Inefficiencies noted by Town staff and observed by SCS include unauthorized access of the waste compactors and lack of education for businesses on the operation of the compactors. The inventory of the keys issued by the Town to businesses that use the waste compactors has become outdated. Some businesses have moved out of the area and the key for the waste compactors is passed along to the new businesses. This allows the new business to use the waste compactor; however, the Town's records are not always updated and hence the Town does not charge the new businesses for use of the waste compactor.

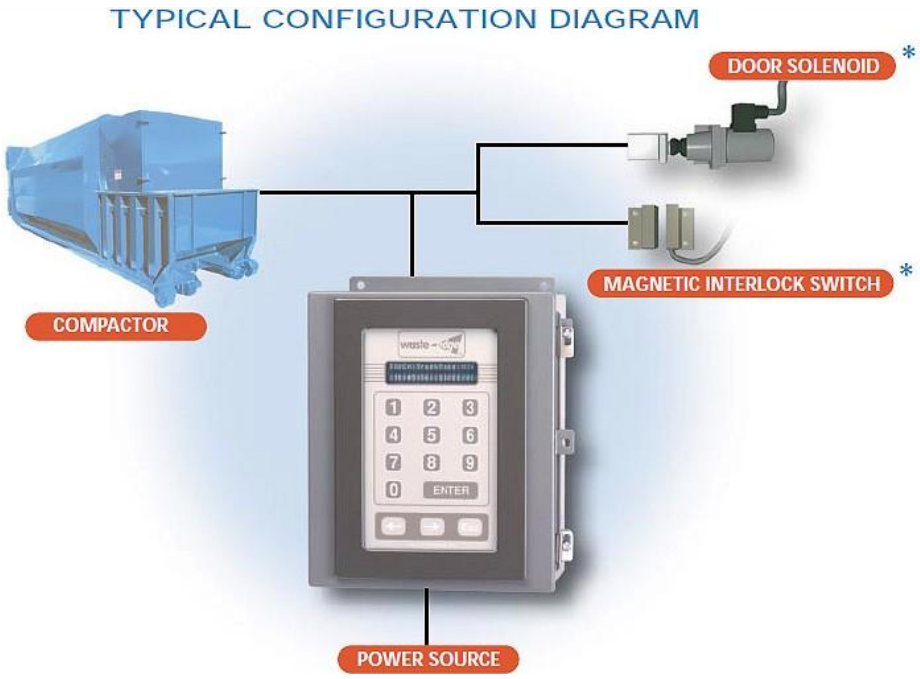
Other inefficiencies noted relate to the operation of the waste compactors. Often, users unlock the waste compactor to dispose of waste but do not make sure the waste compactor is locked when they are finished. This allows unauthorized waste disposal by users that are not registered with the Town and who are not charged for use. Also, users do not cycle the compression mechanism. This results in the dumpster appearing full and requiring service before it is truly full.

The Town should consider changing the locks for the waste compactors and reassess users of the waste compactors to confirm that all users are being properly charged. The new inventory and registration process should include education through brochures or a flyer about the operation of the waste compactors as is currently the practice. Additionally, the Town should install signage in both English and Spanish on the operation of the waste compactors.

The Town should also consider using technology that limits use, records frequency of compactor usage by business, and offers data retrieval for billings. An example is the *Waste Edge 200* by

One Plus Corporation (http://onepluscorp.com/waste-edge-200) which can be installed on most waste compactors. The *Waste Edge 200 User* allows users access by entering an ID number on the monitor keypad shown in Exhibit 4-8. The monitor keypad stores information on usage by business that can be downloaded periodically by the Town.

Exhibit 4-8. Example of Waste Compactor Security and Monitoring Device



The *Waste Edge 200* has a one-time cost of $2,595 per compactor. Installation is straightforward but would require a couple of hours by Town staff. Upgrades to this system are available that allow remote access to data through an analog phone line. The cost for the upgraded system is $2,757 per compactor and $1,675 for software. Upgrades can also include the use of *TrashPass* keys which utilize a digital chip to allow access to the waste compactor. These provide an added level of security since the keys cannot be duplicated and lost keys can be locked out.

4.4 CONCLUSIONS AND RECOMMENDATIONS

A summary of recommendations for improving the Town's existing solid waste collection system are as follows:

- Implement a partial transition to fully-automated residential waste collection for a select route or routes in a pilot phase study planned for FY 2014-15. This would require the purchase of at least one (and likely two) new automated collection truck(s). SCS recommends the Town consider a 28-cubic yard capacity fully automated collection vehicle. This type of vehicle costs approximately $250,000, compared to the Town's current 18 to 20-cubic yard semi-automated rear loading vehicles, which have a budgeted replacement value of $139,000.Following this pilot study, SCS believes the Town may transition most of the existing routes within 2 to 4

years with the replacement of collections fleet vehicles in accordance with the current depreciation and vehicle schedule.

- Require that residential MSW be placed in a Town-issued waste collection cart. SCS suggests the Town provide one cart per household at no charge and, if requested by residents, supply additional carts for an annual fee of $60 per cart. SCS understands the Town believes many households already possess a Town-issued cart. If new carts were purchased for all 11,500 residential households at a cost of $50 per cart, the cart costs incurred by the Town would be approximately $575,000. Implementation will likely require six months to a year and public notification along with a public education campaign will be necessary.

- Develop a collections infrastructure to collect excess residential waste that does not fit into the Town-issued waste collection cart via a hybrid PAYT program (i.e., sticker or bag). Implementing such a modified PAYT program would introduce the concept to Town residents while holding excess waste generators accountable for incremental collections costs.

- Limit residential special collection (exemptions and private driveway service) to those who have mobility challenges. Charge an additional fee of $16.50 per month for special collections associated with private driveway service where no mobility challenge or medical disability exists.

- Continue collecting and delivering white goods to the Orange County Landfill facility for recycling.

- Conduct a formal, technical residential routing study.

  - Evaluate routing configuration of implementation of a 2-day, 3-day and 4-day per week collection schedules.

  - Although this routing study could also evaluate the potential for residential MSW collection on an every other week schedule, SCS believes the Town's residents would likely not embrace such a reduction in the level of solid waste collection services currently being provided.

  - If maintaining a 2-day per week collection schedule, evaluate consolidation of routing maximize the number of households serviced by each route while maintaining legal highway transportation weight limits.

  - Pending the results of a routing study, divide residential waste collection routes into two halves, a northern half and a southern half of town. Collection crews would then collect from half of the town on one collection day and the alternate half on the second collection day.

- A routing and technology study would likely take 4 to 6 months to complete. A budget of $50,000 to $70,000 is estimated to complete a routing and technology study.

- Invest in a customer service system, such as Mobile 311, for residential, commercial, yard waste, and bulky collection services. The cost for Mobile 311 is $60 per month per field user excluding the purchase cost of a smartphone and monthly mobile phone contract. SCS estimates a total monthly cost of approximately $2,700, assuming $100 per month for each mobile phone contract, based on 17 users under the current residential and commercial collection configuration. There is a one-time services setup fee of $500 and training is available for $125/hour. There may be some additional administrative and program costs for such a program, which is beyond the scope of this study, but it is believed to be negligible compared to the monthly operational costs. If the Town wishes to add additional users, the price costs would adjust accordingly. Implementation is suggested to occur in FY 2013-2014.

- Allow commercial waste collection crews to begin waste collection as early as 4:30 a.m.

- Further evaluate commercial collections routing, determine the most efficient customer pick-up frequencies, and maximize container volumes such that the Town may potentially reduce the number of days per week used for commercial waste collection from five to four, or consolidate on-route time to accommodate the additional transportation mileage to Durham.

- Require yard waste be placed in a Town-issued yard waste cart for collection. SCS suggests the Town provide one cart per household at no charge and, if requested by residents, supply additional carts for an annual fee of $60 per cart. Purchase of 11,500, carts at $50/per cart would cost approximately $575,000. This would add about $0.51/household/month to the collection costs for the additional carts, assuming a 10-year amortization period at 4% interest. Assuming an $18/ton disposal fee for yard waste, the Town could consider charging an additional $1.5 to $2/cart per pickup (or something less if it so chooses) for each additional cart to cover the additional disposal costs. Implementation will likely require 6 months to a year and public notification along with a public education campaign will be necessary.

- Require that residents schedule and pay for collection of large piles of yard waste (too large for the cart). SCS suggests the Town charge a fee of $15 to collect a 3-cy pile of yard waste.

- Requiring that all MSW and yard waste be placed in Town-issued carts is anticipated to improve collections efficiency and specifically reduce the time required for crews to complete the collections route. Although it is difficult to quantify the time savings that will be realized, SCS believes it is not unreasonable to expect that the route time be reduced approximately 10% for MSW collections and 15 to 20% for yard waste. Furthermore, this initiative accomplishes a critical preliminary step for a future hybrid PAYT program and the proposed pilot study for automated collections.

- Purchase and use solar-powered trash compactors to replace traditional pedestrian, sidewalk trashcans in typically congested public spaces and other public venues.

- Change locks on existing downtown waste compactors and develop a current inventory of all users. Purchase technology that limits access to registered users that pay for use of the waste compactor.

- The Town may consider clarifying its ordinance(s) regarding the management of larger debris piles resulting from more extensive, non-routine landscaping activities.

5.0 SOLID WASTE COLLECTIONS PROGRAM EVALUATION OF OUTSOURCING

5.1 DECISION FACTORS

With increasing budgetary pressures, many municipalities like the Town of Chapel Hill are evaluating potential solid waste program changes to reduce costs (e.g., elimination or changing certain service levels, increasing service fees, or changing disposal locations) and the feasibility and cost-effectiveness of outsourcing select functions such as solid waste collection. A review of published resources describing municipal solid waste services throughout North Carolina reveals a mix of both government-provided and outsourced solid waste collection services. The decision to self-perform versus outsource solid waste collections is complex, and must consider costs as well as the following intangible factors:

- Continued level of service and control;
- Impacts to Town employment;
- Impacts to waste reduction and recycling goals;
- Community pride and public perceptions;
- Organizational values; and,
- Ability to respond to technological, regulatory, and socio-economic changes.

Evaluating the changes to the Town's cost structure from outsourcing or eliminating certain services (e.g., commercial collection) is relatively straightforward. Various sections of this report present economic analysis of the current solid waste program, and alternate scenarios describing potential changes in service levels (e.g., 3-day versus 2-day per week residential collection routing, commercial collection scenarios, PAYT, organics diversion, and direct hauling to various transfer stations or landfills).

The Town maintains excellent historical records on the costs it incurs for providing solid waste collection and disposal services, including salary and benefits, supplies, operational and maintenance costs (e.g., fuel, oil, consumables, and repair), contracted and equipment replacement costs, and annual capital requirements for new equipment. With each scenario, cost changes to the system can be estimated and long-term cost impacts evaluated. However, assessing how much a contractor would charge the Town to provide a similar level of services is more difficult, and requires a public bid to entice a contractor to provide this information for purposes of comparison.

Comparisons with other similar sized municipalities that have outsourced solid waste collection services can be made, but each municipality is unique with respect to its geography, road conditions, mix of single-family and multi-family residences, disposal market conditions, median income levels, the types and levels of service provided, and how the solid waste system is funded (i.e., fully funded by user fees, partially funded by user fees with balance through the general fund, or whether the collection contractor bills residents directly; see Section 5.4).

The intangible factors noted can be just as important as the cost factors in making a decision to outsource services or not. A discussion of the intangible factors that could affect the Town's decision to outsource solid waste collection services is provided below.

- **Level of Service and Control.** The Town currently provides residential curbside collection, multi-family and commercial collection, bulky waste pickup, and yard waste collection services using in-house resources. Decisions regarding the staffing, equipment, routing, and services provided are solely in the Town's control, with the exception of recycling services, which are provided by Orange County. The Town could outsource all or part of the residential and commercial collection services it currently provides (e.g., residential curbside collection or commercial collection, or both). Providing solid waste collection services using in-house resources allows the Town to: continue to provide exemplary service to its residents; respond directly, promptly, and efficiently to residential and commercial needs; effectively manage complaints; and, provide for special circumstances.

  For example, the Town grants numerous exceptions for special pickup services without having to refer to a contract scope of work as would be the case if these services were outsourced. Under a contracted collection scenario, the costs for responding to special needs and circumstances are more difficult and cumbersome to manage. As such, continuing with in-house collection services provides the Town maximum flexibility to respond to its residential and commercial customers, although it may not be the most cost-efficient approach. In addition, current Town solid waste staff can be reassigned to various other tasks on an as needed basis. In general, the current level of service provided by the Town likely will be higher than if the services are outsourced.

- **Impacts to Town Employment.** Outsourcing of solid waste collection services would likely result in some reduction in the Town's SWS Division work force (salary and benefits).When implementing outsourcing, some positions could be transferred to a private contractor or reassigned within the Town. However, it is unlikely that all the positions would transfer to a private company, nor would the benefits provided to the Town's staff necessarily be comparable to the pay and benefits currently provided by the Town.

- **Impacts to Waste Reduction and Recycling Goals**. The Town is ultimately responsible for providing the infrastructure and municipal services to meet the State's and Town's recycling goals. Under a municipally-operated program, the Town has direct control over its progress towards these goals. However, under an outsourced solid waste collections program, a contractor may have incentives that conflict with these waste reduction goals, depending on the structure of a contract. For example, if paid by the ton collected, a contractor may be incentivized to collect more waste for disposal.

- **Community Pride and Public Perceptions.** Community pride and public perception is difficult to gauge with respect to solid waste collection, except when there are complaints pertaining to problems with the services being provided or inconsistencies or changes in the level of service. Many of the Town's waste collection staff are known throughout the community. The Town's solid waste staff take pride in the services they provide in dealing with special circumstances such as late can set outs, back-door service, or collecting from private driveways or properties that are difficult to access. Outsourcing solid waste collection services could change public perceptions although private companies also take pride in the quality of the services they provide as well.

- **Organizational Values.** In April 2011, the Senior Management Team of the Town adopted a series of values that can be found on the Town's website (http://www.ci.chapel-hill.nc.us/index.aspx?page=1811). The Town's solid waste system is operated consistent with these values and for the benefit of the Town's residents and businesses (its ultimate shareholders). Private companies have values, some of which may be consistent with the Town's, but private businesses also operate for the benefit of its shareholders (i.e., profit goals). The Town must provide a service to its customers. A private contractor must provide a return to its shareholders. Balancing the Town's shareholder interest (i.e., residents) and a contractor's shareholder interest (i.e., profitability) is an ongoing challenge which generally impacts level of service. The Town can make decisions with respect to the level of service provided that a private business might not make because of these differing organizational values.

- **Ability to Respond To Technological, Regulatory, and Socio-Economic Changes.** Private companies tend to respond quicker than municipal governments to changes in technology (e.g., automated collection, single stream recycling), regulatory initiatives (e.g., disposal bans), and socio-economic changes (e.g., downturn in the economy). For example, most private companies are transitioning their fleets to automated collection because doing so reduces labor costs and increases collection efficiency.

  Sometimes implementing such changes in the public sector is more difficult because the change could result in staffing reductions (e.g., automated trucks typically require one operator compared to three for the Town's current rear loader vehicles), and significant capital expenditures. As such, potential staffing reductions which may seem intuitively obvious have to be carefully evaluated in light of the other services provided by the Town under the current staffing census. Often staff performs multiple tasks, which if eliminated because of a programmatic or equipment changes could result in reduced level of service elsewhere in the solid waste program. Furthermore, a private sector contractor is likely not as invested in the impacts to its customers (i.e., Town residents) as the public sector may be regarding the impacts of programmatic changes to waste services.

  When change requires capital investment (e.g., new collection vehicles), the private sector is typically able to more quickly respond to these financial needs with access to

private capital versus public capital. Due to its nature, use of public capital is subject to careful budgeting, planning, and the political process.

Municipal operations also have the added step of gaining consensus and approval of their respective governing political bodies, such as Town Councils or County Boards, before implementing major program changes. The political process can affect the speed of change.

If the Town wishes to consider outsourcing of its collection services, we recommend the following:

- The Town should develop a document that provides a comprehensive description of the types and level of service it provides, and clearly articulate the expectations it would have of a contractor were it to outsource all or part of the services it currently provides. This document could serve as the framework for a bid specification.
- The Town should get input from the community and the private sector regarding the service level descriptions and expectations.
- The Town should develop and issue a request for bid, with the provision that the Town's SWS Division can also respond, and allow the Town the flexibility to award or not award a contract depending on the results of the bids.
- The results of the bids should be evaluated based on costs and the intangible factors described above.

5.2 OUTSOURCING: CONTRACT OR FRANCHISE?

Across the industry, privatization/outsourcing of solid waste collection and disposal services is typically initiated by one of two methods:

- A formal contract agreement for solid waste collections and disposal to a third-party, private sector vendor; or,
- A franchise agreement with a similar private sector entity.

5.2.1 Solid Waste Collections Contract

An illustration of a formal contract arrangement for solid waste collection and disposal services would include:

- A municipality advertising a formal request for proposal (RFP) for solid waste collections and disposal services.
- Selecting a qualified company through this open bid process.
- The winning bidder and the municipality would then negotiate contractual details, including fees and the duration of these contract services.

- Contract terms prescribe that the municipality pays the private company a contract fee for collection and disposal. Reimbursement to the municipality, if sought, is assessed through solid waste service fees applied to its residents and customers, or through tax assessments.

5.2.2 Solid Waste Collections Franchise

A solid waste collections and disposal franchise arrangement is very similar to a contract arrangement with the exception that the private sector contractor providing the service would invoice and collect payments from the residents and business customers in the community for solid waste services and pay the municipality a franchise fee. Costs for solid waste services are thus removed from the municipal ledger. Accordingly, the corresponding tax assessment for solid waste services would typically be adjusted. Compared to a contract arrangement, under the franchise arrangement, municipal government is even further removed from the management of solid waste services, thus having even less control over the service and value provided by the vendor.

5.2.3 General and Town-Specific Contract Considerations

The structuring of an outsourcing contract can have broad implications towards the level of service a contractor may provide, integrating a municipality's values and goals with the contractor's services, and hedging challenges inherent to managing the contract. Examples of typical contract terms and structure relevant to the Town are provided below for consideration should the Town consider outsourcing its solid waste services.

- **Contract Term.** Typically 5 to 10 year duration. Shorter durations typically result in higher bid or negotiated costs.

- **Contract Renewal.** Typically 1 to 3 years. An "Evergreen" term implements and automatic renewal unless contract termination is specifically initiated by one (1) of the parties.

- **Waste Diversion Requirements.** Establishing a waste diversion goal in the contract, potentially subject to a penalty or reduced fee, would assure the Town continues to strive towards State and local mandated goals.

- **Performance Standards.** Like the diversion requirement, establishing clear performance standards, and relative penalties or liquidated damages will help the Town manage and maintain the level of service its residents and Town management may expect from a contractor.

- **Vehicle Requirements.** Prescribing vehicle requirements (e.g., new vehicles, maintenance schedules, etc.) attempt to offset service impacts from equipment failure. In addition, prescribing well maintained vehicles promotes a shared commitment to community pride. Furthermore, if applicable, requiring compressed natural gas (CNG) vehicles or electric vehicles can promote a municipality's commitment to environmental/ "green" initiatives.

- **Rate Adjustments.** Careful consideration of annual rate adjustments must be made along with the contract term. Typical adjustment structures are tied to national or industry-specific indices (e.g., Consumer Price Index), capped at an established maximum, or based on transparent cost analysis and agreed profit margins.

- **Non-Routine Collections.** A contract structure must consider providing collection and disposal services for the Town's special events: sporting events, tournaments, festivals, storms, and natural disasters.

- **Public Education and Outreach.** Specific requirements to continue to engage and educate the Town's customers in waste reduction strategies, recycling, and potential new service offerings.

- **Indemnification.** The Town must be certain to indemnify itself from financial and physical liabilities resulting from contractor misconduct or performance; regulatory non-compliance; vehicle traffic and highway violations and fines; and environmental issues.

- **Insurance and Bonds.** Insurance limits typically range from $3 to $20 million depending on the size of the contract. Performance and payment bonds are a common requirement.

- **Assignment and Transition.** These contract terms promote a continuance of service and protect the Town from adjusting to new service providers throughout the term of the contract.

5.3 SOLID WASTE COLLECTIONS COST ANALYSIS

The Pro Forma scenario model developed by SCS includes a module that allows the Town to project the cost impacts of outsourcing all or part of its current solid waste collection services compared to the annual budget. This outsourcing module allocates the budgeted and projected SWS Division personnel and operational costs and revenues between residential and commercial services in order to assess the cost of service by function. The commercial services are further subdivided between commercial-multi-family and commercial-business services. The pro forma model and allocation methodology are discussed in more detail in Section 14. A case study evaluating outsourcing the Town's commercial collection services is provided in Appendix A. Exhibit 5-1 presents SCS's estimate of the allocated residential and commercial solid waste collection and disposal costs for FY 2012-13. A separate calculation also is provided estimating the $/month/household costs of service for residential curbside collection (including bulky waste), yard waste collection, recycling, and disposal.

Exhibit 5-1. Pro Forma Allocated Budget Costs and Revenues for FY 2012-13 (Status Quo)

Scenario: Current, No new route, Orange County LF, No Automate Residential Scenario A Annual Budget	Residential Allocation ($)	Commercial Allocation ($)	Commercial-Multi-Family ($)	Commercial-Business ($)	Total ($)
	2013	2013	2013	2013	2013
Item	6/30/2013	6/30/2013	6/30/2013	6/30/2013	6/30/2013
TOWN SOLID WASTE BUDGET					
Collection Personnel Services					
Salaries - Full-Time (Including Benefits)	1,408,600	223,800	119,100	104,700	1,632,400
Other Pay	1,900	-	-	-	1,900
Workers Comp Insurance	41,800	10,000	5,300	4,700	51,800
Subtotal, Collection Personnel Services	**1,452,300**	**233,800**	**124,400**	**109,400**	**1,686,100**
Collection Operating Expenses					
Professional Services	400	100	100	-	500
Personnel Agency Payments	7,300	1,700	900	800	9,000
Business Meetings & Training	3,700	900	500	400	4,600
Career Development Training	900	200	100	100	1,100
Advertising	2,000	500	300	200	2,500
Uniform Rentals	10,100	2,400	1,300	1,100	12,500
Landfill Fines	1,100	1,400	700	700	2,500
Charges by Landfill	**449,700**	**489,600**	**260,500**	**229,100**	**939,300**
MSW	396,200	489,600	260,500	229,100	885,800
Yard Waste	53,500	-	-	-	53,500
Fleet Use Charges	**166,400**	**34,000**	**-**	**34,000**	**200,400**
Vehicle Replacement Charges	**270,200**	**40,400**	**-**	**40,400**	**310,600**
Misc. Contracted Services	4,800	17,300	8,600	8,600	22,000
Supplies	39,600	9,400	5,000	4,400	49,000
Fuel	**93,600**	**27,600**	**-**	**27,600**	**121,200**
Subtotal, Operation Expenses	**1,049,800**	**625,500**	**278,000**	**347,400**	**1,675,200**
TOTAL BUDGET, COLLECTION AND DISPOSAL	2,502,100	859,300	402,400	456,800	3,361,300
REVENUE					
Garbage Collection Revenue (Commercial front load service)	-	312,000	47,000	265,000	312,000
Special Trash Collection (bulky, white goods, yard waste, etc.)	8,000	-	-	-	8,000
Compactor Fees (2 downtown compactors)	-	40,000	-	40,000	40,000
Garbage Citations (Commercial and residential)	1,300	1,700	700	1,000	3,000
Sales: Yard Waste Carts	3,000	-	-	-	3,000
Solid Waste Disposal Tax	9,400	11,600	6,200	5,400	21,000
Total, Revenue, $	21,700	365,300	53,900	311,400	387,000
Net Costs (not including Capital Outlay) - Revenue	**2,480,400**	**494,000**	**348,500**	**145,400**	**2,974,300**

SCS Estimate of Allocation by Service Type		
Yard Waste (2/5ths of major costs)	**(2/5ths of major costs)**	
Disposal	$ 53,500	
Personnel	580,920	
Operations	240,040	
Revenue	(8,680)	
Total, Yard Waste, $/year	**$ 865,780**	
	6.27	/mn/HH (11,500 households)
Residential+Bulky Wastes	**Residential+Bulky Waste (3/5ths of major costs)**	
Disposal	$ 396,200	
Personnel	871,380	
Operations	360,060	
Revenue	(13,020)	
Total, Residential Curbside, $/year	**$ 1,614,620**	
	11.70	/mn/HH (11,500 households)
Recycling	$ 7.42	/mn/HH (($37+$52)/year/12 months, not in budget)

5.4 SOLID WASTE COLLECTION AND SERVICE FEE COMPARISONS

Exhibit 5-2 provides a comparison of solid waste collection program rates (Contracted and Government-provided) for several North Carolina municipalities in close proximity to Chapel Hill and/or of equivalent population size. In general, the types and levels of service provided by these municipalities, or their contractor, are similar, and include once per week curbside collection of residential waste, yard waste, bulky waste, and recyclables. However, as this exhibit illustrates, a direct comparison of collection fees as a Town measuring stick can be a misleading metric. Variations exist in the method of collection (automated versus manual collection), backyard versus curbside collection, the scope of recycling services (single stream versus source separated), yard waste services, bulky waste fees, and how the solid waste system is funded as noted in the exhibit notes.

Several communities charge collection fees that do not fully cover the costs of the services provided; therefore, comparison of the referenced rates assessed to residences by each municipality cannot be directly made. The cost figures provided for Chapel Hill are based on the cost estimates provided in Exhibit 5-1.

Exhibit 5-2. Summary of Comparable Solid Waste Programs

City Name	Primary Collector and Published Rates[1]	Distance from Chapel Hill (miles)	Population (Households)[2]
Chapel Hill	**Government:** Residential + Bulky Waste ($11.70/mo./HH) Commercial (Various rates), Yard Waste ($6.27/mo./HH) **Contract:** Recycling ($7.42/mo./HH)[3]	N/A	57,432 (11,500)
Cary	**Government:** Residential + Recycling ($14.00/mo./HH)	22	136,203 (43,637)
Apex	**Contract:** Residential ($9.39-$9.64/mo./HH), Bulky Waste (service fee), Recycling ($2.25-$2.35/mo./HH) **Government:** Yard Waste ($4/mo./HH)	25	37,749 (11,360)
Burlington	**Government:** Residential +Yard Waste ($3.71/mo./HH)[4], Bulky Waste (free or service fee) **Contract:** Recycling ($2.29/mo./HH)	31	50,475 (16,905)
Holly Springs	**Contract:** Residential ($9.50/mo./HH), Recycling ($4.25/mo./HH), Yard Waste ($2.00/mo./HH)	37	24,838 (8,009)
Raleigh	**Government:** Residential, Yard Waste, and Bulky Waste ($7.70/mo./HH)[5] Recycling ($2.60/mo./HH)	33	406,709 (107,789)
Kannapolis	**Contract:** Residential, Yard Waste, Bulky Waste, e-waste, and Recycling (combined environmental fee of $6.85/mo./HH	117	42,828 (16,128)

Notes:

[1] Rates are generally obtained from annual solid waste budgets or Town/City/County websites.

[2] Households estimated using number of housing units and applying housing units in multi-unit structures percentage from US Census Bureau.

[3] Estimated by SCS based on 2013 budget and simplified allocation of costs between various services (3/5th of respective personnel and operations costs to residential and bulky waste pickup and disposal, and 2/5ths to yard waste pickup and disposal. Recycling budget based on fees charged by Orange County @ $37/HH/Year basic fee plus $52/HH/Year urban recycling collection fee. These are "full-cost" estimates of the costs of service, compared to some of the reported fees from other jurisdictions which do not reflect the full costs of service.

[4] This service fee does not appear to fund the entire system. The Town's website refers to this as a solid waste tipping fee.

[5] This service fee does not appear to fund the entire system; the City's FY 2012-13 annual budget indicates over 40% of the solid waste division funding ($12.8M) is through transfers from the general fund.

6.0 DISPOSAL OPTION – DIRECT HAUL TO TRANSFER STATION

Considering the pending closure of the MSW landfill unit at the Orange County Landfill effective July 1, 2013, the Town, along with the other regional municipalities participating in the Inter-Local Agreement must develop and implement a solution to continuing its solid waste management services related to MSW for residents of the Town. A short-term solution is desired to continue to provide the quality of service Town residents' value, while the Solid Waste Services Division (SWSD) and Town Council continue to evaluate their solid waste management services in general.

The results of SCS's analysis of MSW disposal options concluded that "direct haul" to an out-of-county solid waste management/disposal facility is the preferred short-term solution for the Town. In fact, this approach serves as the only viable short-term option since it is not feasible for the Town to site, permit, and construct their own new solid waste management/disposal facility in the timeframe necessary to commence operations by July 2013. In the context of this Study, the term "direct haul" refers to transporting MSW using the Town's solid waste collection vehicles that serve the Town's residential and commercial collections programs.

A review of solid waste industry and state published databases listing permitted public and private solid waste management/disposal facilities in the vicinity of the Town identified a number of viable disposal options, including several permitted solid waste transfer stations.

6.1 WHAT IS A TRANSFER STATION?

Solid waste transfer stations are designed to serve as an intermediate waste handling facility for entities and municipalities that do not own and operate a landfill or other waste disposal facility, and whose distances from these ultimate disposal facilities (e.g., landfills) present inherent inefficiencies in direct hauling small volumes to such facility. At a transfer station, individual waste collection vehicles unload their collected waste onto one or more temporary staging areas or tipping floor. The tipping floor and accompanying operations are typically enclosed in a building and covered by a roof.

Once waste is tipped onto the floor, various heavy equipment gather and consolidate the waste into a larger portable container, usually a transfer trailer. These transfer trailers are typically greater than 50 feet in length and the consolidated waste is typically compacted into the trailer by mechanical means to reduce as much void space as possible before being transported to an ultimate disposal facility, such as a landfill or WTE facility. Furthermore these trailers are equipped with "walking" floors to assist in extracting the compacted waste from the trailer, or the ultimate disposal facility may operate a trailer tipping station. Many transfer stations are accessible by rail where bulk rail cars are loaded with consolidated and compacted waste for rail transport to the ultimate landfill facility.

6.2 IDENTIFIED TARGET TRANSFER STATIONS

The Town engaged SCS to conduct this Study to evaluate the life cycle costs and impact to their Solid Waste Management Program of direct hauling collected waste to various transfer stations. With this evaluation, SCS considered the following variables and inputs to identify the lowest cost option for MSW disposal at existing transfer stations:

- Hauling distance;
- Disposal tipping fees;
- Average daily throughput of the facility;
- Town collection fleet fuel and maintenance costs;
- Fleet modifications or upgrades; and,
- Labor and collections routing modifications.

SCS reviewed several published resources to develop a list of viable target transfer stations for this direct haul evaluation including the "Directory of Non-hazardous Waste Sites-2011" compiled by the Waste Business Journal and cross-referenced to the listing of solid waste facilities currently permitted by NCDENR. The Waste Business Journal Directory provided an electronically sortable list of facilities for North Carolina and surrounding states which included pertinent information such as:

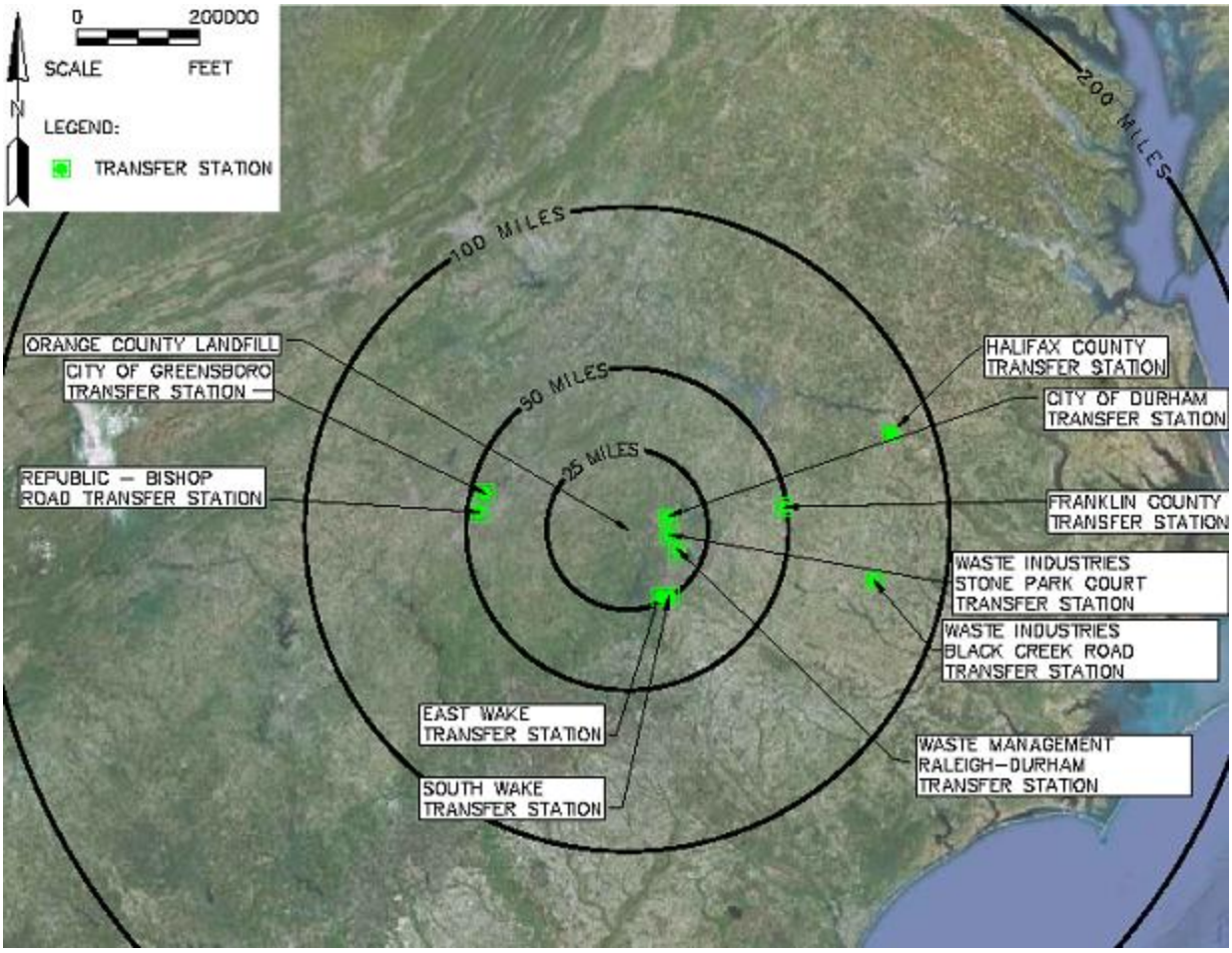
- Facility type (i.e., landfill, transfer station, MRF, etc.);
- Facility address;
- Owner/Operator description (i.e., public or private);
- Contact information;
- Facility permit number;
- Daily average throughput (tons per day);
- Permitted and remaining capacities; and,
- Tipping fees.

Using these references, a compilation of existing permitted transfer stations in North Carolina and Virginia was developed along with the estimated driving distance to each facility from a predetermined location presumed to be the geographic center of the Town, which coincides with the intersection of East Franklin and Columbia Streets. A total of 31 MSW transfer stations were identified within a radius of approximately 115 miles of the Town.

Using the current Town MSW collection and disposal quantities summarized in Section 2 for both residential and commercial operations, and assuming an ongoing collection schedule of 2 days per week, the Town is anticipated to potentially contribute an additional 150 tons of MSW throughput per day that would be required of a target transfer station to manage. Accordingly, existing transfer stations exhibiting a daily average throughput of less than 150 tons were excluded from consideration, since SCS suspects these facilities may not be designed, permitted, or staffed to manage an additional 150 tons of daily throughput. Based on this criterion, SCS identified a total of 12 existing MSW transfer stations within a 100 mile radius of the Town that are considered to be qualified facilities: 7 publicly-owned facilities and 5 privately-owned

facilities. The locations of several of these facilities are depicted below in Exhibit 6-1 and the inventory of all transfer stations considered is summarized in Exhibit 6-2.

Exhibit 6-1. Target MSW Transfer Station Facilities



6.3 SCENARIO MODELING ANALYSIS

The scenario modeling analyses of this short-term disposal option were structured to result in the least impact to the current level of service that Town customers receive and the least disruption to existing Town collections systems, personnel and equipment. The various scenarios anticipate modifications that are made to reflect changes in equipment, personnel, and routing over time. For this MSW disposal option of direct hauling to an existing transfer station, the analysis incorporates the allocated equipment and labor waste collections resources provided in the Town's FY 2012-13 budget.

The evaluation of the direct haul scenarios is structured to enable the residential and commercial crews to avoid having to complete multiple trips to the target transfer stations. The relevant assumptions are further discussed below.

Exhibit 6-2. Summary of Target Solid Waste Transfer Stations

Facility Name	Ownership (Public/ Private)	City/County	State	Average Daily Throughput (Tons/Day)	Tipping Fees ($ per Ton of MSW)	Distance from Chapel Hill, NC (Miles)	Comments
Qualified Facilities							
City of Durham Transfer Station	Public	Durham	NC	587	42.50	17.5	**Short Term Option Target TS**
Waste Industries - Durham Transfer Station	Private	Durham	NC	440	42.50	18	UNC Disposal - this site
WMI - Raleigh Transfer Station	Private	Morrisville	NC	208	57.00	18	Waste Management, Inc. - Wake Co.
South Wake Transfer Station	Public	Apex	NC	TBD	TBD	28	Permitted but Inactive; Negotiate w/Wake Co.
East Wake Transfer Station	Public	Raleigh	NC	80	36.00	35	Target TS - Confirm Throughput
City of Greensboro Solid Waste Transfer Station	Public	Greensboro	NC	768	41.00	50	
Randolph County Transfer Station	Public	Randolph	NC	189	44.00	53	
Republic - Bishop Road Transfer Station	Private	Greensboro	NC	570	35.58	56	Tip fee from 2011 Greensboro RFP
Vance County Transfer Station	Public	Henderson	NC	156	60.00	58	
Waste Industries - Black Creek Road Transfer Station	Private	Wilson	NC	380	52.28	77	Other Waste Industries Facility closer
Waste Industries - Rocky Mount Transfer Station	Private	Rocky Mount	NC	312	51.82	87	Other Waste Industries Facility closer
Halifax County Transfer Station	Public	Halifax	NC	213	47.00	109	

Notes:
1. Chapel Hill projected to collect an estimated 150 tons of MSW per day in FY2013 assuming both Residential and Commercial are collected during 2 days per week.
2. TBD - To Be Determined
3. NA - Not Applicable

6.3.1 Collections Fleet Modifications and Capital Expenditures

6.3.1.1 NCDOT Overweight Regulations

North Carolina Department of Transportation (NCDOT) imposes weight limits on commercial vehicles traveling on state highways, roadways, and bridges for the protection of the traveling public, prevention of damage to this infrastructure, and to promote efficient operation of the public transportation system. As described in the North Carolina General Statute 20-118, these weight limits are determined by the gross weight transmitted to the road by a combination of the vehicle's axles. For the purposes of the Town's collection vehicles, these combinations are 2-axles and 3-axles respectively. Gross weight is defined as the axle weight plus any load carried by that axle, or distributed across a combination of axles.

- The single-axle weight limit is 20,000 pounds (10 tons);
- The tandem-axle weight limit is 38,000 pounds (19 tons); and,
- The gross weight imposed on the highway by any axle group is determined by the distance in feet between axles.
    - 2-axle vehicles range between 38,000 and 40,000 pounds
    - 3-axle vehicles range between 38,000 and 60,000 pounds

Under the current disposal practice involving Town collection vehicles transporting MSW to the Orange County Landfill, these weight restrictions are rarely monitored and enforced due to the limited travel on state roadways beyond the Town limits. However, these state-enforced weight restrictions become more of a concern while transporting collected waste a longer distance to a transfer station. Annual and trip-specific overweight permits are issued by NCDOT; however, upon further discussions with NCDOT permitting staff, waste collection vehicles are not applicable because their operation and loads are deemed to be potentially further divisible in order to meet NCDOT weight limits.

A $500 fine may be levied for an overweight violation. Further civil penalties are assessed of $0.04 per pound for the first 1,000 pounds; $0.06 per pound for the next 1,000 pounds; and $0.10 per pound for each additional pound.

6.3.1.2 Residential Collection Vehicles

The Town's existing residential rear loader collection trucks have a rated capacity of 18 to 20 cubic yards (cy). According to data provided by the Town, the tare (i.e., empty) weights of these single-axle and tandem-axle residential rear loader vehicles range between 20,000 and 28,000 pounds (10 to 14 tons). Based on the known tare weight of the Town's collection vehicles and their waste hauling capacities, several vehicles are subject to potential overweighting depending upon their axle configuration and the load weight distributed across their axles. For example:

- The average tare weight of a Town tandem axle vehicle is approx. 24,850 pounds;

- Assuming a typical compaction density of 750 pounds per cy, the waste in a fully loaded 19 cubic yard vehicle may weigh 14,250 pounds;

- Thus the total gross weight of a loaded vehicle would equal 39,100 pounds;

- Depending on the distribution of the total load between axles, the tandem axle weight limit transmitted to the road (38,000 pounds) may be exceeded; and,

- For the Town's older single-axle collection vehicles, assuming 2/3^{rds} of the total gross load is distributed over a single rear axle, the single-axle weight limit (20,000 pounds) would be exceeded.

  - 39,100 pounds * 0.66 = 25,806 pounds

6.3.1.3 Commercial Collection Vehicles

The Town's existing commercial front loader collection trucks have a rated capacity of 28 cy. According to data provided by the Town, the tare weights of these tandem-axle commercial front loader vehicles range between 38,000 to 39,000 pounds (approx. 19 tons). Based on the known tare weight of the Town's collection vehicles and their waste hauling capacities, these commercial vehicles are subject to potential overweighting depending upon their axle configuration and the load weight distributed across their axles. For example:

- Assuming a typical compaction density of 750 pounds per cy, the waste in a fully loaded 28 cubic yard vehicle may weigh 21,000 pounds;

- Thus the total gross weight of a loaded vehicle would equal approx. 59,000 pounds; and,

- Assuming two-thirds of the total gross load is distributed over the rear tandem axles, the tandem axle weight limit transmitted to the road as determined by the distance between axles (min. 38,000 pounds at 8 feet or less) may be exceeded.

  - 59,000 pounds * 0.66 = 38,940 pounds

6.3.1.4 Fleet and Routing Modifications

Accordingly, fleet and routing modifications are necessary to:

- Enable the Town's existing single-axle residential trucks to comply with the NCDOT weight limit;

- Enable the Town's existing tandem-axle commercial trucks to comply with the NCDOT weight limit; and,

- Accommodate for periodic use of single-axle residential collections vehicles.

6.3.1.5 Existing Fleet Summary and Projected Replacement Schedule

As described in Section 4, presently the Town residential collections program maintains seven (7) front line, tandem-axle, rear loader, compactor trucks and maintains four (4) single-axle, rear loader, compactor trucks in a reserve fleet. For the current FY 2012-13, the SWSD is budgeted to operate six (6) residential collections routes; however, the division has continue to operate seven (7) residential routes as it has done in past years. This analysis notes that the current resource allocation is a reduction from the previous fiscal year, FY 2011-12 when seven (7) collection routes were budgeted. The budget reductions in FY 2012-13 were based on positions being held vacant and the knowledge that a budget amendment would be needed ones collection improvements were established based on results from this Study.

Review of the Town collection vehicle data indicates the Town has consistently replaced and updated its front line (i.e., primary) residential fleet with tandem-axle vehicles, while maintaining the older, single-axle vehicles to be engaged when any of the front line vehicles are out-of-service.

- The oldest tandem-axle truck was purchased in December 2005;
- The next oldest truck in 2007;
- Three (3) trucks were acquired in 2008; and,
- The two (2) newest trucks were purchased in 2011.

For the purposes of projecting on-going capital expenditures for fleet replacement, the analysis assumed that collection vehicles will be replaced on a 7-year operating schedule.

The Town commercial collections fleet is comprised of: two (2) front line, tandem-axle, front loader compactor trucks purchased in 2010; and one (1) backup tandem-axle, front loader compactor truck purchased in 2004. Similarly, SCS has assumed these commercial collections vehicles will be replaced over a 7-year operating schedule.

6.3.1.6 Fleet Routing and Modifications

To accommodate the current residential collection volume, collection practices, routing configuration, and Town resource allocation, as well as to enable compliance with the NCDOT weight limits, while maintaining the same level of service to Town residents, SCS recommends the Town conduct a formal routing study to thoroughly evaluate all of these factors and most efficiently configure collections routing. SCS recognizes that an infinite number of routing and resource scenarios may be considered; however for the purposes of this comprehensive study we evaluated the following scenarios:

- Seven (7) collection routes 2 days per week; or,
- Six (6) collection routes 3 days per week.

A cursory analysis of the Town's residential routing scenarios based on the most recent annual residential MSW disposal (FY 2010-11) and current vehicle collection capacities presents the projected minimum routing configurations for the referenced compacted load density depicted in Exhibit 6-3.

Exhibit 6-3. Route Capacity Analysis

# Collection Days (per week)	CY per Collection Route (750 lb/cy)			CY per Collection Route (1,000 lb/cy)		
	6 routes	7 routes	8 routes	6 routes	7 routes	8 routes
2	28.74	24.63	21.55	21.55	**18.47**	16.16
3	**19.16**	16.42	14.37	14.37	12.32	10.78
4	14.37	12.32	10.78	10.78	9.24	8.08
5	11.49	9.85	8.62	8.62	7.39	6.47

Notes:
1. Total annual residential MSW disposal = 6,725 tons.
2. SWANA resources support typical industry compaction density of in-truck waste ranges between 500 and 1,000 pounds per cy.
3. Each route anticipated to include one 19 cubic yard rear loader compaction vehicle making one trip per collection day.

Adjusting the number of collection days or routes, is necessary to adequately distribute the daily collection volume among the subject vehicles, thus enabling each collection route to make a single trip to the transfer station during each collection day, while also mitigating the potential of the residential collection vehicles exceeding their legal weight limit during the periodic use of the single-axle trucks comprising the reserve fleet. This analysis highlights that understanding the Town's actual waste compaction density is critical to configuring the route distribution.

This analysis assumes that as the existing cubic yard single-axle fleet reaches the end of its operating life (deemed to be 7 years), these vehicles will be replaced with new 18 to 20 cubic tandem-axle vehicles and the older tandem-axle vehicles will become a backup piece of equipment in the reserve fleet. Certainly the replacement vehicles purchased in the future could be larger capacity, such as 25 cubic yards. Accordingly, these tandem-axle vehicles will further enable the Town to meet its load capacity and NCDOT weight limits.

Furthermore, the analysis includes a separate scenario which evaluates phasing in automated collection vehicles targeting appropriate areas of the Town which can accommodate automated collection services. Refer to Section 4 for further discussion regarding introduction of automated collections.

For this short-term, direct haul option, additional routing and scheduling modifications to the commercial fleet are anticipated to accommodate the legal weight limits and multiple direct haul trips to a transfer station. This analysis anticipates that implementing the commercial collections recommendations, including a routing study, identified in Section 4 will promote collection efficiencies that would likely allow the commercial collections vehicles to continue to make two (2) daily trips to the target transfer station while evenly distributing the waste into highway legal loads.

6.3.2 Fleet Fuel and Maintenance Costs

All Town collections vehicles are garaged, serviced, maintained, and fueled at the Public Works facility. The vehicles dispatch from and return to this same location after each collection route. The Town maintains a detailed maintenance, repair, and fuel consumption log for each vehicle

reported in units of cost and summarized for the current month, 12-month rolling total, and vehicle life-to-date. In addition vehicle mileage is tracked and recorded in the same manner.

Using these actual data, the historical and projected fleet operational cost was computed on a per mile basis and allocated accordingly by vehicle to residential and commercial sector operations. As previously discussed in Section 2, Exhibit 6-4 summarizes these projected vehicle operations costs. The scenario modeling analysis includes these costs as new vehicles are added to the fleet in the projections according to their respective use (i.e., residential or commercial), which are adjusted in accordance with inflation assumptions.

Exhibit 6-4. Projected Town Vehicle O&M Cost

Vehicle Description	Maintenance & Repair Cost ($$ per mile)	Total Cost Including Fuel ($$ per mile)
Commercial Front Loader	1.43	2.35
Residential Rear Loader	1.38	2.28
Hooklift	1.45	1.74
Knuckleboom	0.91	1.60
Scooter Truck	0.37	0.66
Flat Bed	0.22	0.58
Pick-up/Passenger Car	0.08	0.23

The analysis assumes a cost of diesel fuel of $2.91 per gallon based on information provided by the Town. This cost is the tax-exempt purchase price of fuel provided by the Town at the PW garage facility.

6.3.3 Impacts to Task-Based Collections System Structure

As described above, this analysis concludes that routing modifications are necessary to accommodate the projected waste disposal volume, corresponding NCDOT weight limits, and additional transit and queuing time required to transport and dispose of waste at an existing transfer station. A review of current collections schedules (7 residential routes 4 days per week, 2 commercial routes 5 days per week) and compensation structure indicates:

- The average residential collection route (i.e., task) requires approximately 6 working hours per day. The collections staff is typically free to leave each day upon the completion of their task. Residential collections staff are currently compensated for four (4) 10-hour days (i.e., 40-hours) per week with Wednesdays off.

- The average commercial collection route requires 5 working hours per day. Similarly, the collections staff is typically free to leave each day upon the completion of their task. The commercial collections staff is compensated for five (5) 8-hour days (i.e., 40 hours) per week.

Using the distance to each target transfer station and assuming average highway speeds consistent with these distances, the off-route (i.e., transport and tip) time associated with each transfer station location was estimated. For comparison, SCS calculated available off-route time

by subtracting the current total average route time incurred with transport to the Orange County Landfill (including off-route time) from the current task compensation structure. For example:

Total Route Time = [(# of Routes) (Average Route Time)] + (Round Trip Travel Time) + (Load Tipping Time)

Where: Average Route Time = 6 hours
Round Trip Travel Time to Orange County = 12 miles at 35 mph
Assumed Tipping Time = 0.33 hours

Task Compensated Time = (# of Routes) (1 Trip per Route per day) (10 hours per day)

Additional Available Off-Route Time = (Task Compensated Time) – (Total Route Time)

Based on these analyses and the limited resource allocation scenarios evaluated SCS is projecting that each residential collection crew may absorb between 1.53 and 3.81 hours per day in off-route crew transport time. We assumed approximately 1.2 hours of additional off-route time to drive to and from and unload at a transfer station in Durham.

Commercial collections manpower allocation can absorb an additional and estimated 4.34 hours per crew of off-route transport time per day before additional labor costs are incurred by the Town. In summary, sufficient flex time currently exists to account for the additional transport and queuing time required for each route.

Understandably, changes to collections routing and resource allocation would potentially impact the existing task-based collections structure. However, this routing and resource allocation evaluation is necessary to meet the projected MSW transportation and disposal requirements within current budgetary constraints modeled with this short-term, direct haul option, while maintaining the current level of service to Town customers.

6.3.4 Other Scenario-Consistent Assumptions

The results of the scenario modeling for each transfer station disposal scenario factor in the forfeiture of current transportation and disposal costs associated with using the Orange County Landfill. As previously stated, the disposal tip fee at the Landfill is $57 per ton and the mileage to the landfill was calculated to be 6 miles one-way. For each scenario the difference in tipping fee and off-route travel time to the Orange County Landfill was included. In addition, throughout the lifecycle cost, a 3% cost of inflation from the baseline year of 2012 was assumed.

Irrespective of the variable site-specific mileage and tip fee data for each transfer station location input into the model, the following assumptions remained constant for each transfer station modeling scenario:

- Additional Collection Vehicles
  - Baseline 2013 capital expenditure for previously purchased vehicles was provided as $311,000
  - 7-year depreciation schedule (i.e., projected to be replaced every 7 years)

- 4% financing rate

- All scenarios include a 25% cost contingency for budgetary purposes

6.4 SCENARIO MODELING RESULTS

The scenario modeling analysis provides a comparison of the Town's current annual budget for FY 2012-13 to projected budget expenditures for FY 2013-14. The evaluation of the lifecycle costs to direct haul MSW to identified transfer stations within approximately 100 miles of the Town concludes that the most cost-effective options are to contract disposal with either the City of Durham transfer station (Permit No. 3212-T) or the Waste Industries transfer station (Permit No. 3214-T) also located in Durham. Each of these locations is approximately 18 miles from the Town and indicates a current gate rate tip fee of $42.50 and $41.00 per ton respectively. The analysis indicates that disposal at the majority of other existing transfer stations that were deemed qualified candidates demanded a higher tip fee and the few transfer stations identifying a lower tip fee are located further away, causing the additional transportation costs to offset the gains in disposal cost savings.

6.4.1 Summary Results

The analysis has evaluated the direct haul option using Town collection vehicles to transport MSW to an existing transfer station beginning in FY 2013-14 in conjunction with the closure of the Orange County Landfill (July 1, 2013). This analysis provides results for the residential collections routing scenarios described above.

6.4.1.1 Results - Six Routes, 3 Days Per Week

In this analysis, projected capital expenditures include the replacement of one (1) rear loader compactor truck with a new 18 to 20 cubic yard compacter truck in accordance with the Town's current budgeted capital expenditure assumptions. No additional labor costs are projected. Compared to the current FY 2012-13 budget, the analysis projects an additional $88,300 dollars would be incurred of the Town budget in FY 2013-14 to implement this option. Exhibit 6-5 summarizes the comparative cost analysis of the top five (5) identified transfer stations versus current budgetary expenses.

Exhibit 6-5. Summary of Direct Hauling to Transfer Station Scenarios (6 Routes, 3 Days Per Week)

Program Scenario A	Current-FY2013	A	B	C	D	E	F
	DH to OCLF	DH to TS	DH to TS	DH to TS	DH to TS	DH to TS	DH to TS
Disposal Facility Name	**Orange County LF**	**City of Durham TS**	**Waste Industries - Durham Transfer Station**	**WMI - Raleigh Transfer Station**	**Siler City Transfer Station**	**WCA Waste - Raleigh Transfer Station**	**East Wake Transfer Station**
Transfer Miles							
Transfer Miles, one-way	6	42.5	42.5	57	45.35	47.28	36
Tansfer Miles, roundtrip	12	17.5	18	18	31	33	35
Average Transfer Speed, mph	35	2783	2783	2783	2783	2783	2783
2014 Budget Results- 2013 Budget Results							
TOWN SOLID WASTE BUDGET							
Collection Personnel Services							
Salaries - Full-Time	1,632,400	49,000	49,000	49,000	49,000	49,000	49,000
Other Pay	1,900	100	100	100	100	100	100
Workers Comp Insurance	51,800	1,500	1,500	1,500	1,500	1,500	1,500
Additional Labor From Direct Haul	-	-	-	-	12,700	23,200	33,600
Subtotal, Collection Personnel Services	1,686,100	50,600	50,600	50,600	63,300	73,800	84,200
		-	-	-	-	-	-
Collection Operating Expenses		-	-	-	-	-	-
Professional Services	500	-	-	-	-	-	-
Personnel Agency Payments	9,000	300	300	300	300	300	300
Business Meetings & Training	4,600	100	100	100	100	100	100
Career Development Training	1,100	-	-	-	-	-	-
Dues & Subscriptions	-	-	-	-	-	-	-
Pagers	-	-	-	-	-	-	-
Cellular Phones	-	-	-	-	-	-	-
Advertising	2,500	100	100	100	100	100	100
Personnel Advertising	-	-	-	-	-	-	-
Equipment Rentals	-	-	-	-	-	-	-
Uniform Rentals	12,500	400	400	400	400	400	400
Landfill Fines	2,500	100	100	100	100	100	100
Charges by Landfill	**939,300**	(191,200)	(190,900)	44,600	(145,100)	(113,500)	(296,800)
MSW	885,800	(193,600)	(193,300)	42,200	(147,500)	(115,900)	(299,200)
Yard Waste	53,500	2,400	2,400	2,400	2,400	2,400	2,400
Fleet Use Charges	**200,400**	99,700	103,900	103,900	209,900	226,400	241,900
Fleet Use Charges	200,400	6,000	6,000	6,000	6,000	6,000	6,000
Additional Fleet Use Charges for Direct Haul	-	93,700	97,900	97,900	203,900	220,400	235,900
Vehicle Replacement Charges	**310,600**	-	-	-	-	-	-
County Budgeted Vehicle Replacement Charge	310,600	-	-	-	-	-	-
Misc. Contracted Services	22,000	-	-	-	-	-	-
Supplies	49,000	1,500	1,500	1,500	1,500	1,500	1,500
Fuel	**121,200**	67,300	70,000	70,000	142,600	153,700	164,800
Vehicle Fuel	121,200	3,500	3,500	3,500	3,500	3,500	3,500
Additional Fuel Charge for Direct Haul	-	63,800	66,500	66,500	139,100	150,200	161,300
Subtotal, Operation Expenses	1,675,200	(21,700)	(14,500)	221,000	209,900	269,100	112,400
	-	-	-	-	-	-	-
TOTAL BUDGET, COLLECTION AND DISPOSAL	3,361,300	28,900	36,100	271,600	273,200	342,900	196,600
Contingency, 25% on Additional Collection Costs		54,400	56,100	56,100	104,000	113,500	122,700
Total Potential Additional Costs (Savings)		**83,300**	**92,200**	**327,700**	**377,200**	**456,400**	**319,300**

This Table calculates the difference between current practices and the various scenarios for FY 2014 and compared to current FY 2013 budget.

6.4.1.2 Results – Current Operations with Seven Routes, 2 Days Per Week

Similarly, in this analysis, projected capital expenditures include the replacement of one (1) rear loader compactor truck with a new 18 to 20 cubic yard compacter truck in accordance with the Town's current budgeted capital expenditure assumptions. However, additional salary expenses are projected, but will be comparable to staffing expenditures in FY 2011-12. In FY 2012-13, the staffing budget was reduced due to open positions being intentionally held vacant to allow for organizational flexibility pending the results of this Study. To include three additional fulltime employees for the residential collections crew along with the replacement of one rear loader compactor truck, the analysis projects an additional $368,300 dollars would be incurred of the Town budget in FY 2012-13 to implement this option. Exhibit 6-6 summarizes the comparative cost analysis of the top five (5) identified transfer stations versus current budgetary expenses.

Exhibit 6-6. Summary of Direct Hauling to Transfer Station Scenarios for Current Residential Route Configurations (7 Routes, 2 Days Per Week)

Program Scenario A	Current-FY2013	A	B	C	D	F
	DH to OCLF	DH to TS	DH to TS	DH to TS	DH to TS	DH to TS
Disposal Facility Name	**Orange County LF**	**City of Durham TS**	**Waste Industries - Durham Transfer Station**	**WMI - Raleigh Transfer Station**	**Siler City Transfer Station**	**East Wake Transfer Station**
Transfer Miles						
Transfer Miles, one-way	6	42.5	42.5	57	45.35	36
Tansfer Miles, roundtrip	12	17.5	18	18	31	35
Average Transfer Speed, mph	35	2783	2783	2783	2783	2783
2014 Budget Results- 2013 Budget Results						
TOWN SOLID WASTE BUDGET						
Collection Personnel Services						
Salaries - Full-Time	1,632,400	256,200	256,200	256,200	256,200	256,200
Other Pay	1,900	100	100	100	100	100
Workers Comp Insurance	51,800	1,500	1,500	1,500	1,500	1,500
Additional Labor From Direct Haul	-	-	-	-	9,500	18,400
Subtotal, Collection Personnel Services	1,686,100	257,800	257,800	257,800	267,300	276,200
		-	-	-	-	-
Collection Operating Expenses		-	-	-	-	-
Professional Services	500	-	-	-	-	-
Personnel Agency Payments	9,000	300	300	300	300	300
Business Meetings & Training	4,600	100	100	100	100	100
Career Development Training	1,100	-	-	-	-	-
Dues & Subscriptions	-	-	-	-	-	-
Pagers	-	-	-	-	-	-
Cellular Phones	-	-	-	-	-	-
Advertising	2,500	100	100	100	100	100
Personnel Advertising	-	-	-	-	-	-
Equipment Rentals	-	-	-	-	-	-
Uniform Rentals	12,500	400	400	400	400	400
Landfill Fines	2,500	100	100	100	100	100
Charges by Landfill	**939,300**	(191,200)	(190,900)	44,600	(145,100)	(296,800)
MSW	885,800	(193,600)	(193,300)	42,200	(147,500)	(299,200)
Yard Waste	53,500	2,400	2,400	2,400	2,400	2,400
Fleet Use Charges	**200,400**	112,700	116,900	116,900	221,900	254,900
Fleet Use Charges	200,400	19,000	19,000	19,000	19,000	19,000
Additional Fleet Use Charges for Direct Haul	-	93,700	97,900	97,900	202,900	235,900
Vehicle Replacement Charges	**310,600**	-	-	-	-	-
County Budgeted Vehicle Replacement Charge	310,600	-	-	-	-	-
Misc. Contracted Services	22,000	-	-	-	-	-
Supplies	49,000	1,500	1,500	1,500	1,500	1,500
Fuel	**121,200**	75,100	77,800	77,800	150,100	172,300
Vehicle Fuel	121,200	11,600	11,600	11,600	11,600	11,600
Additional Fuel Charge for Direct Haul	-	63,500	66,200	66,200	138,500	160,700
Subtotal, Operation Expenses	1,675,200	(900)	6,300	241,800	229,400	132,900
	-	-	-	-	-	-
TOTAL BUDGET, COLLECTION AND DISPOSAL	3,361,300	256,900	264,100	499,600	496,700	409,100
Contingency, 25% on Additional Collection Costs		111,400	113,100	113,100	159,800	175,900
Total Potential Additional Costs (Savings)		**368,300**	**377,200**	**612,700**	**656,500**	**585,000**

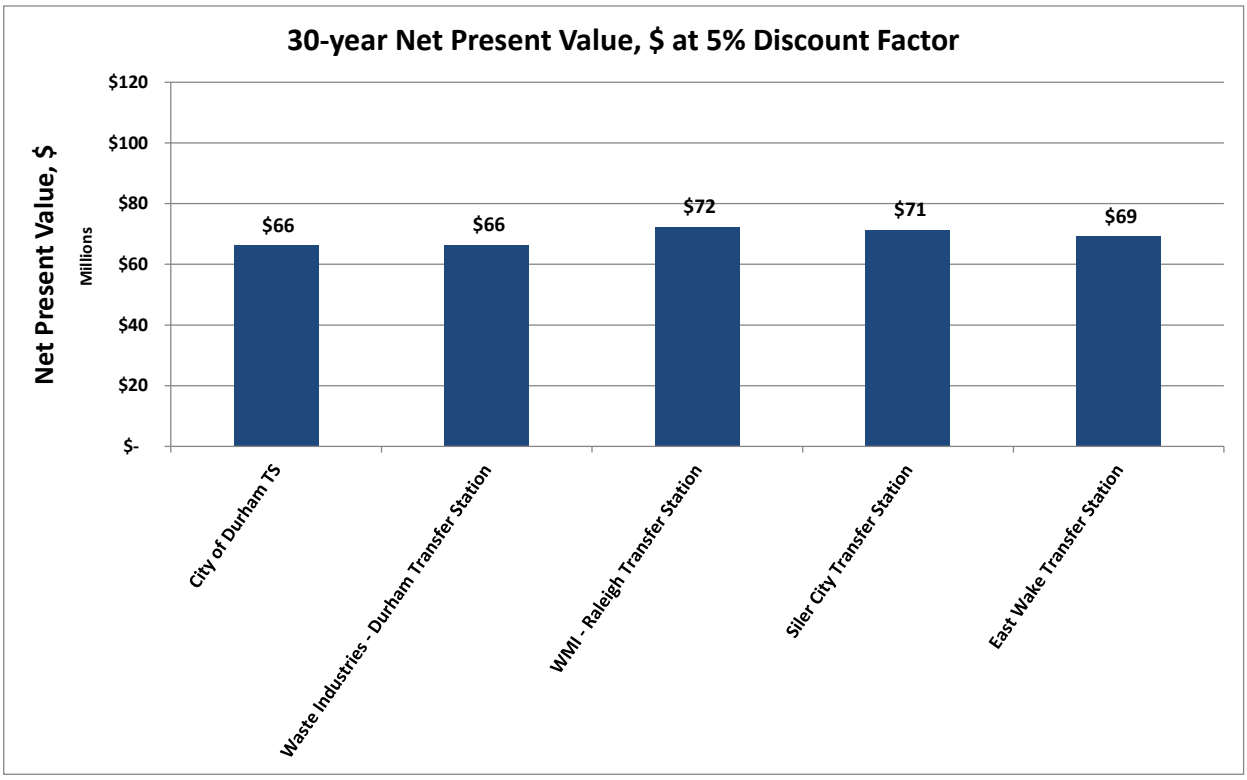
This Table calculates the difference between current practices and the various scenarios for FY 2014 and compared to current FY 2013 budget.

6.4.2 Net Present Value Evaluation

The financial modeling conducted under this evaluation provides the capability to project and calculate the Town's total SWSD program cost over a 30-year period while assuming the implementation of the various disposal options evaluated. This analysis assumes a 5% discount factor and includes year-over-year adjustments for inflation, capital expenditure schedule, salary projections, and other Town and scenario-specific program assumptions. The total program costs for each disposal option may then be compared in terms of present term, 2013 value.

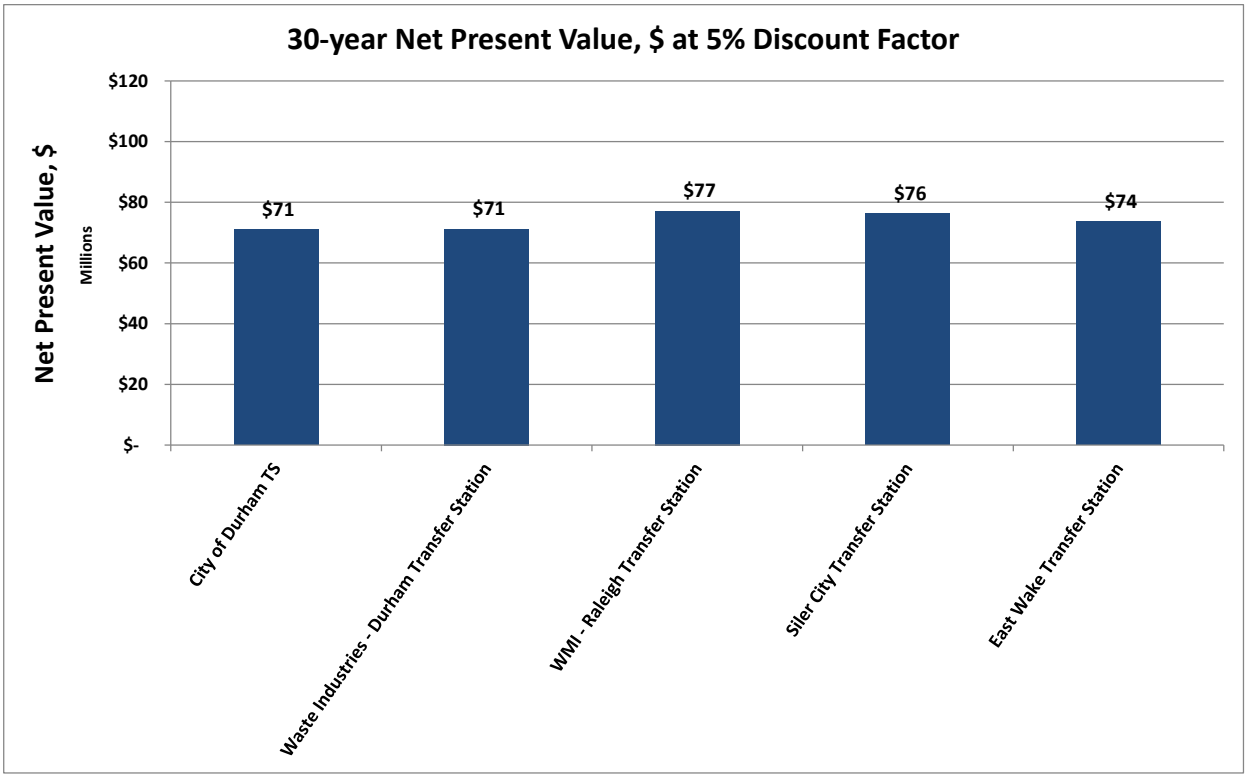
When comparing the option of direct hauling to an existing transfer station located in Durham, versus continuing disposal to the Orange County Landfill, over a 30-year period, the estimated net present values are comparable: $66 million for a program direct hauling MSW to a Durham transfer station and $68 million representing the status quo of disposal with Orange County, as depicted below in Exhibit 6-7. This analysis projects a costs savings when transitioning the Town's existing seven (7) routes to six (6) residential collections routes on a 3-day collection schedule.

Exhibit 6-7. Net Present Value of Direct Hauling to Transfer Station (6 Routes, 3 Days Per Week)



Comparatively, the current seven residential collection route configuration that operates 2-days per week is projected to have a net present value of $71 million to transport waste to a transfer station in Durham, as depicted in Exhibit 6-8.

Exhibit 6-8. Net Present Value of Direct Hauling to Transfer Station for Current Residential Route Configurations (7 Routes, 2 Days Per Week)



6.4.3 Recommendations

6.4.3.1 Solicit a Request for Quotes for Transfer Station Tipping Fee

Based on SCS recommendation the Town requested quotes from the City of Durham and Waste Industries for the disposal of the Town's MSW to be collected and transported by Town resources. The City of Durham confirmed that it would accept the Town's projected MSW volume at their advertised tip fee rate of $42.50 per ton. Waste Industries provided a quote of $41.00 per ton to the Town for a 5-year contract term.

6.4.3.2 Transition to a 3-day Per Week Collection Schedule

With this analysis, significant cost savings may be realized in transitioning the residential collection routes to a 3-day collection schedule. The Town is currently budgeted to collect using six (6) routes in FY 2012-13 to maintain some organizational flexibility, pending the results of this Study; however, it is recognized that there are actually seven (7) routes currently being dispatched using temporary personnel. Key parameters driving the results of this scenario are that:

- The Town is currently budgeted to collect using six (6) routes. The Town utilizes temporary labor to staff a seventh route and this matter is expected to be addressed through a budget amendment at the October 29, 2012 meeting.

- Collection crews appear to have the available off-route time to accommodate an additional collection day within the current compensation assumptions; and,

- Additional equipment and labor is not necessary.

This appears to be the least cost option to manage a transition to hauling waste to the Durham transfer station. However, with this option the following additional items should be considered:

- The routing and technology study may indicate alternate collection day options would be optimal.

- New routes must be delineated to implement this option.

- Drivers must be trained and learn new collection routes.

- Outreach efforts must be conducted to inform residents of collection day changes.

- Implementation would need to be carefully planned and coordinated, allowing sufficient time to properly implement change.

6.4.3.3 Capital Expenditures

Regardless of the routing option scenario, SCS recommends SWSD replace the oldest 18 or 20 cubic yard single-axle rear loader compactor truck with a new, 19 cubic yard tandem-axle collection vehicle in accordance with the Town's programmed capital expenditures for FY 2012-13. cubic yard In addition to this programmed capital expense, SCS recommends the Town procure one (1) new automated collection vehicle and implement one (1) automated collection route, as described above, resulting in seven (7) residential collections routes. Refer to Section 4.3.1 for a discussion on the planning efforts and action items necessary prior to implementation of an automated collection route.

6.4.3.4 Additional Collections Staff

Based on the timing of the closure of the Orange County Landfill in July 2013, continuing the Town's current operations with seven residential collections routes is recommended in the short-term. This will require additional funding in the Division's FY 2012-13 budget as the Town has intentionally kept positions vacant and filled them with temporary employees to allow for organizational flexibility, pending the results of this Study.

6.4.3.5 When to Transition?

The impacts to this disposal scenario were evaluated with regard to the timing of accomplishing the transition to an existing transfer station.

Should the Town continue with its current seven route operations and implement an immediate transition to the Durham transfer station, the analysis suggests the Town would incur an additional cost of $117,800 versus the cost of $368,300 if initiating this option on July 1, 2013 at the close of the Orange County landfill.. SCS recommends the Town identify several dedicated residential routes, regularly serviced by tandem-axle rear loader vehicles, and that will likely conform to the NCDOT weight limit, to begin direct hauling to a transfer station selected through a process as described in Section 6.4.3.1. In the event a truck is suspected of being overweight, or if a vehicle is in repair and a single-axle vehicle must be deployed, these collection events may be transported and disposed at the Orange County Landfill. Accordingly capital investments may be incurred when planned and scheduled with the closure of the Orange County Landfill for the FY 2013-14 budget year.

6.5 OTHER CONSIDERATIONS

Apart from this analysis of impact to the SWSD budget, several other factors weigh into the longer term evaluation of this disposal option of direct hauling to an existing transfer station. These considerations are not as readily quantified with respect to fiscal impact since they relate to risk management, environmental impacts, and socio-economic issues. However, these factors have the potential to create financial implications and indeed resonate with the Town's stated values and goals and must be considered along with the financial evaluation. Several of the more decisive factors include:

- Safety of the Town solid waste collections staff hauling waste longer distances and over more heavily traveled roadways;
- Increased risk to other motorists due to hauling waste longer distances and over more heavily traveled roadways;
- Sustainability concerns with the consumption of more diesel fuel to transport waste this longer distance;
- An increase in greenhouse gas emissions related to waste collection trucks traveling further distances;
- A desire to manage Town-generated waste internally and not having to rely on a neighboring disposal system, and a loss of control over ultimate disposal and costs;
- A potential loss of focus on Town waste reduction goals; and,
- Long-term job creation and retention impacts from a transition to automated collections.

7.0 DISPOSAL OPTION – SITE/ CONSTRUCT NEW TRANSFER STATION

7.1 EVALUATE DEVELOPMENT OF A NEW TOWN-ONLY OR REGIONAL TRANSFER STATION

SCS evaluated the feasibility of the Town developing a new municipal solid waste transfer station, for Town-only use as well as considering the economic impacts of regional use. As noted in the previous section, solid waste transfer stations are facilities where collection vehicles unload waste onto a tipping floor where it is consolidated into a larger container, usually a transfer trailer, before being transported to an ultimate disposal facility, such as a landfill or WTE facility. The analysis provides the following:

- Summary of the challenges and obstacles to siting a new transfer station in the Town (e.g., economics, social justice, siting, permitting criteria, etc.).
- Summary of the benefits of siting and operating a Town-owned transfer station in the Town, either on its own or in conjunction with other regional municipal partners.
- A cost estimate for the site selection, permitting, design, capital construction, and operation for a Town-only or regional transfer station for a 20-year period in order to evaluate this disposal option along with other solid waste management options.

This evaluation of a new transfer station presented below is general in nature and compliments previously identified solid waste management options for the Town.

7.1.1 Transfer Station Siting Challenges, Advantages, and Disadvantages

Siting a new transfer station within the Town limits, or the surrounding area, would be challenging regardless of whether it is planned to accept waste collected by the Town exclusively or accept waste generated within other regional communities as well. Transfer station siting efforts require extensive environmental, socio-economic, transportation studies, and public and regulatory involvement. The process usually requires between 12 to 15 months to complete, but can vary depending on the specific location and multiple factors. Historically, SCS is aware there have been previous efforts to evaluate siting, permitting, and operating a transfer station, both in the Town as well as in Orange County.

7.1.1.1 Summary of Historical Transfer Station Siting Efforts

During 2009, Orange County engaged in an extensive effort to identify and evaluate potential parcels that were candidate sites for a transfer station. The historical record of these efforts is well-documented on http://www.co.orange.nc.us/recycling/olver/index.html. The evaluation applied exclusionary, technical, and community-specific criteria and ranked the potential parcels. A short-list of 10 properties was developed for further consideration, and one additional site (Site 744, on Millhouse Road) was later added. Upon soliciting public comments, the list was

narrowed down to two candidate sites. Specific parcels that were identified and considered as part of the evaluation, and parcel-specific siting activities that deserve mentioning include:

- The County conducted a site evaluation for Site 056 (also termed the West 54 LLC or Howell Property) and Site 759, owned by the Orange Water and Sewer Authority (OWASA) and referred to as the OWASA property as documented in the report titled "Site Investigation & Evaluation of West 54 LLC and OWASA Sites," prepared by Olver, Inc., and dated April 16, 2009.

- The County performed an environmental assessment for Site 056 as documented in the report titled "Environmental Assessment: Site 056," prepared by Olver, Inc., and dated February 2009. A draft environmental assessment was also prepared for Site 759.

- The County conducted an environmental assessment on Site 669 (also termed the Paydarfar site) as documented in the report titled "Environmental Assessment: Paydarfar Site," prepared by Olver, Inc., and dated September 2009.

- The County considered Site 744 which is a portion of a 57-acre parcel located between Millhouse Road and I-40, north of the Town Operations Center, as documented in the report titled "Site Evaluation: Site 744 (Millhouse Road)," prepared by Olver, Inc. and dated June 8, 2009. The portion of the parcel considered for the transfer station was outside of the Chapel Hill Joint Planning Area (JPA) Transition Area and within the Rural Buffer, which restricts public utility services.

Other regional municipal partners have advocated for consideration of a 20-acre parcel at the intersection of Interstate I-40 and Route 86 as a potential candidate site.

Upon conducting initial discussions with the Town, SCS became aware that another potential candidate site is an 11-acre Town-owned parcel located southeast of the intersection of Millhouse Road and the service road to the Transit parking lot, and positioned south of the Town Operations Center complex parking lot and west of the Town's Transportation Department facility. This parcel is within the Chapel Hill JPA Transition Area and not located within the Rural Buffer. The parcel is bisected by a stream and appears to be of adequate size to accommodate a transfer station. As part of this analysis, SCS did not evaluate this site using exclusionary, technical, or community-specific criteria similar to the County's efforts.

7.1.1.2 Social Justice and Regulatory Concerns

As demonstrated, both The Town and Orange County have extensive experience regarding the process of attempting to site a transfer station. We understand the decision to close the Orange County Landfill was in part due to local community concerns with ongoing landfill operations and social justice issues (Rogers-Eubank Community). Based on the public response to the County's previous transfer station siting efforts, renewed efforts by the Town to site a new transfer station, within the Town's planning jurisdictional limits, is likely to be contentious and difficult, and would require strong political leadership, community relations, and resolve to be successful.

In addition, the availability of land within the Town's limits that meets the regulatory siting restrictions outlined in the North Carolina Department of Environment and Natural Resources solid waste regulations (15A NCAC 13B) and community criteria that would be developed is limited. Additional studies would be needed to confirm availability of such land.

7.1.1.3 Advantages

Based on our experience, the following advantages are associated with developing a new transfer station within the Town's planning jurisdictional limits:

- Reduced collections and disposal transportation costs and its associated consumption of fossil fuels.
- Ability to control the Town's waste disposal, select an ultimate disposal facility, and secure a long-term contract to provide increased stability with respect to future landfill disposal costs.
- Greater self-sufficiency as compared to direct haul scenarios involving facilities owned and operated by others.
- Ability to quickly respond to emergencies or other unanticipated conditions.
- A regional transfer station would reduce the costs incurred by the Town, while promoting collaboration, since a portion would be allocated to regional members.

7.1.1.4 Disadvantages

Based on our experience, the following disadvantages are associated with developing a new transfer station within the Town's planning jurisdictional limits:

- Long-term commitment required (operational periods).
- Community opposition and potential perceived impacts to communities surrounding the transfer station (e.g., noise, vectors, odors, and traffic), although modern transfer stations employ mitigation measures that can reduce or eliminate these impacts.
- Increased responsibility for environmental stewardship resulting from a Town owned and operated solid waste facility. For example: operations would include design and implementation of environmental protection measures, environmental monitoring requirements, and good housekeeping activities when compared to direct haul scenarios. However, these environmental risks are manageable and notably fewer liabilities are associated with a transfer station versus operating a Town landfill.
- Significant capital investment required (see discussion below).
- Developing a new transfer station could require 2 to 3 years to complete. As such, it is not available as a short-term alternative to the Town in the near future.

7.1.2 Projected 20-Year Disposal Needs

7.1.2.1 Population and Disposal Quantity Projections

SCS evaluated the projected MSW disposal requirements for a Town-only and regional transfer station over the next 20 years. The projections take into account the projected changes in population during this period. The projected population changes for the Town between now and 2035 are presented in Exhibit 7-1.

Exhibit 7-1. Population Projections, Town of Chapel Hill

Year	Population Estimates	% Change Per Year*
2000	48,715	
2010	57,233	
2015	65,748	2.98%
2025	77,767	2.39%
2035	80,483	1.62%

Source: See Report Section 2.1.4.1
*Based on 2010

The MSW disposal rates were projected based on a 1.62% per year increase for both the Town-only and the regional transfer station options. A further refinement on the regional population growth trends could be considered, but for the purpose of this evaluation, the same growth rate was used for the Town and Region analysis. The yearly projected MSW quantities for a Town-only and regional transfer station beginning in FY 2014-15 and extending through FY 2033-34 are presented in Exhibit 7-2. This exhibit does not include solid waste program changes that could ultimately reduce the quantity of MSW requiring delivery to a transfer station (and transport to an ultimate disposal facility); therefore, the estimated disposal rates presented are conservative.

Exhibit 7-2. 20-Year Disposal Quantity Projections

Projection Year	Fiscal Year	Town-Only MSW Quantities (tons)	Town-Only MSW Throughput (tons/day)	Regional MSW Quantities (tons)	Regional MSW Throughput (tons/day)
1	2015	15,810	76.0	22,450	107.9
2	2016	16,060	77.2	22,810	109.7
3	2017	16,310	78.4	23,160	111.3
4	2018	16,580	79.7	23,540	113.2
5	2019	16,860	81.1	23,940	115.1
6	2020	17,130	82.4	24,320	116.9
7	2021	17,400	83.7	24,710	118.8
8	2022	17,690	85.0	25,120	120.8
9	2023	17,980	86.4	25,530	122.7
10	2024	18,260	87.8	25,930	124.7
11	2025	18,580	89.3	26,380	126.8
12	2026	18,870	90.7	26,800	128.8
13	2027	19,170	92.2	27,220	130.9
14	2028	19,490	93.7	27,680	133.1
15	2029	19,800	95.2	28,120	135.2
16	2030	20,120	96.7	28,570	137.4
17	2031	20,450	98.3	29,040	139.6
18	2032	20,780	99.9	29,510	141.9
19	2033	21,110	101.5	29,980	144.1
20	2034	21,470	103.2	30,490	146.6
Totals		369,920		525,300	

Note: Regional MSW Quantities reflect a 42 percent increase compared to Town-Only Quantities and are intended to represent the Town of Chapel Hill combined with the Town of Carrboro.

7.1.2.2 Sizing an Appropriate Facility

Hypothetical transfer station dimensions and waste throughput quantities were developed based on a number of assumptions regarding the maximum daily waste acceptance rate, facility configuration, traffic flow patterns, and setbacks to the property line from the transfer station building footprint.

Assuming MSW collection occurs 4 days per week, 52 weeks per year, the daily MSW throughput quantities for a Town-only facility range from 75 tons per day (tpd) in FY 2014-15 to approximately 100 tpd in FY 2033-34. Thus, a new transfer station anticipated to accommodate the Town-only MSW generation for the next 20 years should be sized to manage 100 tpd. Based on SCS's experience, a transfer station sized to handle 100 tpd of MSW would require a building footprint in the 10,000 square foot (sf) range, situated on a site pad of at least 2 acres within a

total property parcel size equal to at least 4 acres to accommodate site access, truck queuing, and turning radius.

As an example of one potential option involving regional cooperation, if the Town of Chapel Hill decides to construct a transfer station to accommodate the Town of Carrboro plus their own MSW generation for the next 20 years, the facility should be sized to manage 150 tpd. Based on SCS's experience, a transfer station sized to handle 150 tpd of MSW will require a building footprint in the 13,500 sf range, situated on a site pad of at least 2.5 acres within a total property parcel size equal to at least 5 acres.

With reference to traffic associated with the Town-only scenario, the existing collection vehicles would be expected to visit the facility once per day when collections are occurring. Therefore, incoming residential collection vehicle traffic is estimated to be approximately seven trucks, 2 days per week. Commercial collection vehicle traffic is estimated to be approximately two trucks, 5 days per week. The outgoing transfer trailer vehicle traffic for this scenario is expected to be one or two trailers per day, 5 days per week. If the facility was located on Millhouse Road, this would equate to two to three additional trucks per day.

7.1.3 Estimated Transfer Station Development Costs

SCS prepared conceptual budget cost estimates for the construction and operation for both the Town-only and regional transfer station scenarios. The construction cost estimates include costs for siting, permitting, design, building construction, scalehouse and scales, maintenance facilities, utilities, entrance roads, transfer trailer staging area, and ancillary support facilities. The cost estimates do not assign any costs for land acquisition, which reflects an assumption that the facility will be located on an existing Town-owned property. Should the Town need to consider land acquisition costs in this analysis, these preliminary land acquisition costs are described further in Section 11 for the consideration of developing a Town landfill. The cost estimates also do not consider LEED Certified or green building standards. It is expected that meeting LEED Certified or green building standards would increase the cost of constructing a transfer station, but this analysis was not included in this report as only one transfer station on the eastern seaboard was identified by SCS as meeting LEED standards.

The cost estimates are based on SCS's experience working with municipal and private clients throughout the region, and were prepared to provide an order-of-magnitude estimate of the critical aspects of transfer station construction and operation. If the Town were to develop a transfer station under either scenario, a more detailed estimate would need to be prepared based on actual site information. Exhibit 7-3 and Exhibit 7-4 present a summary of the estimated pre-development and capital construction costs to develop a new Town-only or regional transfer station, respectively.

For conceptual cost estimating purposes, the capital costs for each scenario are amortized over the 30-year projection period at 4% interest to estimate the yearly allocated capital expenditure costs.

Exhibit 7-3. Estimated Cost to Develop a Town-Only Transfer Station

DESCRIPTION	UNIT	QUANTITY	LABOR MATERIAL & EQUIPMENT COST	SUBTOTAL	TOTAL
PRE-DEVELOPMENT COSTS					
Land Acquisition / Purchase	ac	5	$0	$0	
Permitting	ls	1	$100,000	$100,000	
Engineering, Legal, & Admin	ls	1	$425,000	$425,000	
					$525,000
CONSTRUCTION					
Mobilization/Demobilization	ls	1	$70,000	$70,000	
					$70,000
EROSION CONTROL					
Clearing and Grubbing	ac	4	$6,000	$24,000	
Erosion Control Measures	ls	1	$15,000	$15,000	
Site Restoration (seeding/mulching/vegetation)	ls	1	$10,000	$10,000	
					$49,000
BUILDING COSTS					
Site Work (Excavation, Grading, Paving, and Landscaping)	sf	87,120	$6.50	$566,280	
Utilities (Electrical, Water, Sewage, Storm water)	sf	10,000	$2.00	$20,000	
Structures (Concrete, Structural, Doors, Fire control, Lighting, Roof)	sf	10,000	$35.00	$350,000	
					$936,280
OTHER SITE WORK					
Maintenance Building	ls	1	$10,000.00	$10,000	
Scalehouse	ls	1	$150,000.00	$150,000	
Office Equipment (computer, supplies, telephone, etc.)	ls	1	$7,500	$7,500	
Truck Scales	ls	2	$50,000.00	$100,000	
Site Lighting	sf	87,120	$0.50	$43,560	
Signage, Locking gate, Fencing	ls	1	$25,000	$25,000	
Construction Quality Assurance & Certification (third-party)	ls	1	$66,067	$66,067	
					$402,127
				TOTAL	**$1,982,407**
				CONTINGENCY (20%)	**$396,481**
				PRELIMINARY COST ESTIMATE TOTAL	**$2,379,000**

Exhibit 7-4. Estimated Cost to Develop a Regional Transfer Station for Town of Chapel Hill and Town of Carrboro

DESCRIPTION	UNIT	QUANTITY	LABOR MATERIAL & EQUIPMENT COST	SUBTOTAL	TOTAL
PRE-DEVELOPMENT COSTS					
Land Acquisition / Purchase	ac	5	$0	$0	
Permitting	ls	1	$100,000	$100,000	
Engineering, Legal, & Admin	ls	1	$425,000	$425,000	
					$525,000
CONSTRUCTION					
Mobilization/Demobilization	ls	1	$85,000	$85,000	
					$85,000
EROSION CONTROL					
Clearing and Grubbing	ac	5	$6,000	$30,000	
Erosion Control Measures	ls	1	$15,000	$15,000	
Site Restoration (seeding/mulching/vegetation)	ls	1	$10,000	$10,000	
					$55,000
BUILDING COSTS					
Site Work (Excavation, Grading, Paving, and Landscaping)	sf	108,900	$6.50	$707,850	
Utilities (Electrical, Water, Sewage, Storm water)	sf	13,600	$2.00	$27,200	
Structures (Concrete, Structural, Doors, Fire control, Lighting, Roof)	sf	13,600	$35.00	$476,000	
					$1,211,050
OTHER SITE WORK					
Maintenance Building	ls	1	$10,000.00	$10,000	
Scalehouse	ls	1	$150,000.00	$150,000	
Office Equipment (computer, supplies, telephone, etc.)	ls	1	$7,500	$7,500	
Truck Scales	ls	2	$50,000.00	$100,000	
Site Lighting	sf	108,900	$0.50	$54,450	
Signage, Locking gate, Fencing	ls	1	$30,000	$30,000	
Construction Quality Assurance & Certification (third-party)	ls	1	$80,900	$80,900	
					$432,850
				TOTAL	**$2,308,900**
				CONTINGENCY (20%)	**$461,780**
				PRELIMINARY COST ESTIMATE TOTAL	**$2,771,000**

7.1.4 Estimated Transfer Station Operations Costs

Exhibit 7-5 and Exhibit 7-6 present the estimated annual operation costs for the Town-only and regional transfer station scenarios, respectively. The annual operational costs include personnel, and equipment needed to operate a MSW transfer station. The annual operational costs also include an annual permit renewal fee ($750).

Exhibit 7-5. Estimated Annual O&M Cost for Town Only Transfer Station Scenario

No.	Item Description	Quantity	Unit	Engineer's Unit Price Est.	Engineer's Total Estimate
1	Personnel Salaries	3	LS	$ 40,000	$ 120,000
2	Personnel Benefits	3	LS	$ 15,000	$ 45,000
3	Transfer Station Equipment Debt Service	2	LS	$ 15,000	$ 30,000
4	Transfer Station Equipment Maintenance / Repair	2	LS	$ 5,000	$ 10,000
5	Equipment - Lease/Rental	1	LS	$ 5,000	$ 5,000
6	Vehicle Fuel	6,000	Gal	$ 3.50	$ 21,000
7	Vehicle Supplies	1	LS	$ 2,500	$ 2,500
8	Wastewater Treatment	200,000	Gal	$ 0.03	$ 6,000
9	Paving / Concrete	1	LS	$ 5,000	$ 5,000
10	Electricity & Heating	1	LS	$ 7,500	$ 7,500
11	Water & Sewer	1	LS	$ 2,000	$ 2,000
12	Telecommunications / Information Technology	1	LS	$ 2,500	$ 2,500
13	Vehicle Insurance	1	LS	$ 1,500	$ 1,500
14	General / Environmental Insurance	1	LS	$ 1,000	$ 1,000
15	Engineering / Consulting Services	1	LS	$ 5,000	$ 5,000
16	Environmental Monitoring Services	1	LS	$ 5,000	$ 5,000
17	Legal Services	1	LS	$ 5,000	$ 5,000
18	Mowing & Other Contracting Services	1	LS	$ 2,500	$ 2,500
19	Dues & Association Fees	1	LS	$ 1,500	$ 1,500
20	Permit Fees	1	LS	$ 1,000	$ 1,000
21	Office Supplies	1	LS	$ 1,000	$ 1,000
22	Janitorial	1	LS	$ 500	$ 500
23	Operations & Maintenance Supplies	1	LS	$ 1,500	$ 1,500
24	Uniforms	1	LS	$ 500	$ 500
25	Miscellaneous Maintenance / Repair	1	LS	$ 2,500	$ 2,500
					$ -
	SUBTOTAL				$ 285,000
	CONTINGENCY (20%)				$ 57,000
	TOTAL ESTIMATED ANNUAL OPERATING COST				**$ 342,000**
	WASTE ACCEPTANCE RATE	100	tpd		
	ANNUAL OPERATING COST PER TON				$ 21.63

Exhibit 7-6. Estimated Annual O&M Cost for Regional Transfer Station Scenario for Town of Chapel Hill and Town of Carrboro

No.	Item Description	Quantity	Unit	Engineer's Unit Price Est.	Engineer's Total Estimate
1	Personnel Salaries	4	LS	$ 40,000	$ 160,000
2	Personnel Benefits	4	LS	$ 15,000	$ 60,000
3	Transfer Station Equipment Debt Service	2	LS	$ 15,000	$ 30,000
4	Transfer Station Equipment Maintenance / Repair	2	LS	$ 5,000	$ 10,000
5	Equipment - Lease/Rental	1	LS	$ 10,000	$ 10,000
6	Vehicle Fuel	9,000	Gal	$ 3.50	$ 31,500
7	Vehicle Supplies	1	LS	$ 5,000	$ 5,000
8	Wastewater Treatment	300,000	Gal	$ 0.03	$ 9,000
9	Paving / Concrete	1	LS	$ 7,500	$ 7,500
10	Electricity & Heating	1	LS	$ 10,000	$ 10,000
11	Water & Sewer	1	LS	$ 2,500	$ 2,500
12	Telecommunications / Information Technology	1	LS	$ 2,500	$ 2,500
13	Vehicle Insurance	1	LS	$ 2,000	$ 2,000
14	General / Environmental Insurance	1	LS	$ 1,000	$ 1,000
15	Engineering / Consulting Services	1	LS	$ 5,000	$ 5,000
16	Environmental Monitoring Services	1	LS	$ 5,000	$ 5,000
17	Legal Services	1	LS	$ 5,000	$ 5,000
18	Mowing & Other Contracting Services	1	LS	$ 2,500	$ 2,500
19	Dues & Association Fees	1	LS	$ 1,500	$ 1,500
20	Permit Fees	1	LS	$ 1,500	$ 1,500
21	Office Supplies	1	LS	$ 2,000	$ 2,000
22	Janitorial	1	LS	$ 1,000	$ 1,000
23	Operations & Maintenance Supplies	1	LS	$ 1,500	$ 1,500
24	Uniforms	1	LS	$ 1,000	$ 1,000
25	Miscellaneous Maintenance / Repair	1	LS	$ 5,000	$ 5,000
					$ -
	SUBTOTAL				$ 372,000
	CONTINGENCY (20%)				$ 74,400
	TOTAL ESTIMATED ANNUAL OPERATING COST				**$ 446,400**
	WASTE ACCEPTANCE RATE	150	tpd		
	ANNUAL OPERATING COST PER TON				$ 19.88

7.1.5 Summary of Transfer Station Development, Construction, and Operations Costs

Exhibit 7-7 presents a summary of the estimated costs to develop, operate, close, and provide for post-closure care for the Town-only and regional transfer station scenarios. This exhibit demonstrates the importance of economies of scale in developing and operating a transfer station. As depicted in the exhibit, operating a Town-only transfer station would be more costly on a dollar per ton basis than operating a regional transfer station. This is attributed to the economies of scale achieved by accepting greater waste quantities, while also sharing investment of capital costs with a neighboring municipality or recovering a portion of the capital costs through tip fees assessed to the neighboring municipality.

Note that Exhibit 7-5 and Exhibit 7-6 include the amortized costs for equipment as an annual operating cost (refer to item 3 – Transfer Station Equipment Debt Service); whereas, Exhibit 7-7 itemizes the equipment debt service costs separately. Also, note that the total estimated annual operating costs and per ton operating costs in Exhibit 7-5 and Exhibit 7-6 are presented in current dollars whereas the values presented in Exhibit 7-7 are in FY 2014-15 dollars to coincide with anticipated commencement of transfer station operations.

Exhibit 7-7. Summary of Estimated Transfer Station Costs

	Town-Only Transfer Station			Regional Transfer Station		
Cost Item	Estimate	Annual Cost	$/ton	Estimate	Annual Cost	$/ton
Pre-Development Cost, $	$630,000	$49,000	--	$630,000	$49,000	--
Total Capital Construction Cost, $	$1,749,000	$137,000	$11.76	$2,271,000	$167,000	$9.62
Equipment Cost, $	$276,000	$49,000	$3.10	$276,000	$49,000	$2.18
Annual Operations Cost, $/year		$325,000	$20.56		$442,000	$19.69
Annual Haul Costs, $		$160,000	$10.12		$246,000	$10.96
Annual Disposal Costs, $		$637,143	$40.30		$904,735	$40.30
Annual Costs, $		$1,357,143	$85.84		$1,857,735	$82.75
Tonnage (2015)	15,810			22,450		
Break Even Tip Fee, $/ton			$85.84			$82.75

7.1.6 Identified Target Destination Landfills

SCS reviewed several published resources to develop a list of viable target destination landfills for the ultimate disposal of waste processed through this new transfer station evaluation including the "Directory of Non-hazardous Waste Sites-2011" compiled by the Waste Business Journal and cross-referenced to the listing of solid waste facilities currently permitted by NCDENR. The Waste Business Journal Directory provided an electronically sortable list of facilities for North Carolina and surrounding states which included pertinent information such as:

- Facility type (i.e., landfill, transfer station, MRF, etc.);
- Facility address;
- Owner/operator description (i.e., public or private);
- Contact information;
- Facility permit number;
- Daily average throughput (tons per day);

- Permitted and remaining capacities; and,
- Tipping fees.

Using these reference sources, a compilation of existing permitted landfills in North Carolina and Virginia was developed along with the estimated driving distance to each facility from a predetermined location presumed to be the geographic center of the Town, which coincides with the intersection of East Franklin and Columbia Streets. Within a radius of approximately 160 miles, SCS identified 23 MSW landfill facilities for consideration as destination landfills for waste accepted at a new transfer station.

SCS identified a total of 4 landfills within a 50 mile radius of the Town, another 9 landfills within a 100 mile radius, and 10 additional landfill facilities greater than a 100 mile radius. Of these 23 landfills, 9 are privately-owned facilities; however, 7 of these 9 private landfills are located more than 100 miles from the Town. These individual facilities are discussed in Section 10.

As discussed in Section 10, the distance traveled to each target landfill along with the tipping fees charged by each facility factor into the total cost analysis of operating a transfer station. However, for the purposes of evaluating these landfill facilities within the context of operating a transfer station, SCS's scenario modeling includes the economies of scale recognized in transfer costs using bulk tractor trailers versus direct haul using Town-owned collection vehicles.

7.2 SCENARIO MODELING RESULTS

The scenario modeling analysis provides a comparison of the Town's current annual budget for FY 2012-13 to projected budget expenditures for FY 2014-15. The evaluation compares the lifecycle costs to permit, construct, and operate a new MSW transfer station and haul the waste in transfer trailers to various identified landfills within approximately 100 miles of the Town. The evaluation concludes that the most cost-effective option is to contract hauling and disposal with the Upper Piedmont Landfill (Permit No.73-04) located in Person County. This facility is located approximately 46 miles from the Town and indicates a current gate rate tip fee of $32.67 per ton.

The analysis indicates that transfer to and disposal at the majority of other existing landfills that were deemed qualified candidates demanded a higher tip fee and the few landfills identifying a lower tip fee are located further away, causing the additional transportation costs to offset the gains in disposal cost savings. The analysis identified two (2) public landfills, the Alamance County - Austin Quarter Landfill and South Wake Landfill, within close traveling distance from the Town; however, these landfill facilities were excluded from consideration at this time as each is permitted by NCDENR for disposal of wastes generated exclusively within the counties. However, discussion of regional collaboration may make one or more of these facilities a viable option.

Consistent with the Town's current operations, the routing configurations, labor, and equipment are allocated such that each residential collections crew can collect along its dedicated route, transport, and dispose 1 to 2 loads per day (or an average of 1 load per day) at the Orange

County Landfill. The commercial collections crew usually accomplishes disposal of two loads at the Landfill per day. The evaluation of the new transfer station scenarios is structured to enable the residential and commercial crews to complete the same number of trips to a hypothetical new transfer station as they currently perform to the Orange County Landfill.

Relevant assumptions critical to this new transfer station disposal scenario analysis are summarized below. More detailed discussions of these assumptions are presented previously in Section 6, direct hauling MSW to a target transfer station facility.

- Collections Fleet Modifications and Capital Expenditures
  - Consider compliance with NCDOT Overweight Regulations a non-issue
  - Systematic Replacement of Single-axle vehicles with Tandem-axle vehicles
  - Assumed the Town's 2013 budgeted annual capital expense for previously purchased equipment as provided = $311,000 per year
- Existing Fleet Summary and Projected Replacement Schedule
  - Seven (7) Residential routes running 2 days per week
  - Two (2) Commercial routes
  - Seven (7) year vehicle replacement schedule initiating with existing vehicle age
- Fleet Modifications
  - No additional Residential rear loader collection vehicle is necessary
  - Annual amortization cost according to a 7-year amortization schedule and 4% financing rate
  - No modifications to Commercial collections fleet
- Routing Modifications
  - No additional Residential route is necessary; seven Residential routes running 2 days per week
  - No additional 3-man crew for residential route
  - Analysis excluded consideration of automated collections route
- Fleet Fuel and Maintenance Costs
  - Determined from historical Town records
  - Incremental savings resulting from traveling shorter distance to new transfer station
  - Includes incremental costs for replacement vehicle(s) on a year-over-year basis
- Impacts to Task-Based Collections System Structure
  - No modification of existing off-route time to transport MSW to new transfer station
  - Maintain available flex time currently awarded to collections staff
- Other Assumptions
  - Each modeling scenario includes the forfeiture of current transportation and disposal costs associated with hauling to the Orange County Landfill but accounts for the transportation and disposal costs associated with hauling waste in transfer trailers to target destination landfill on facility-by-facility basis
  - 3% cost of inflation
  - Baseline fiscal year of FY 2012-13 for comparison purposes

While the scenario assumptions are similar to the direct haul scenario, a few distinct differences are noted as related to collection routing and fleet modifications, and transportation-related factors.

7.2.1 Summary Results

The analysis has evaluated the option to have Town collection vehicles deliver MSW to a new transfer station located within the Town limits beginning in FY 2014-15 (July 1, 2014), where it will be consolidated, loaded into transfer trailers, and transported to an existing landfill. Accordingly, projected capital expenditures include the planned replacement of one (1) rear loader compactor truck in accordance with the 7-year vehicle replacement schedule. Because the Town collection vehicles travel distances and times traveling to a new transfer station within the Town limits would be similar to their current travel associated with disposal at the Orange County Landfill (and comparatively shorter distances and times than would be required under the direct haul scenarios) no new residential routes or additional salary expenses for collections crew is anticipated. Compared to the current FY 2012-13 budget, the analysis projects an additional $592,000 dollars would be incurred of the Town budget in FY 2014-15 to implement this option. Exhibit 7-8 summarizes the comparative cost analysis of the top identified destination landfills versus current budgetary expenses.

7.2.2 Net Present Value Evaluation

The financial modeling conducted under this evaluation provides the capability to project and calculate the Town's total SWSD program cost over a 30-year period while assuming the implementation of the various disposal options evaluated. This analysis assumes a 5% discount factor and includes year-over-year adjustments for inflation, capital expenditure schedule, salary projections, and other Town and scenario-specific program assumptions. The total program costs for each disposal option may then be compared in terms of present term, 2013 value.

Comparing the option of permitting, constructing, and operating a new transfer station to accept MSW collected by the Town exclusively and hauling the waste in transfer trailers to the Upper Piedmont Landfill, versus continuing disposal to the Orange County Landfill, over a 30-year period, the net present value for this scenario of $75 million is greater than the $68 million associated with the status quo, as depicted below in Exhibit 7-9. This is expected considering the additional expense incurred in permitting, design, construction, and operation of the transfer station over the projected life cycle.

Considering the option for a regional transfer station presents some inherent advantages. The pre-development, construction, and equipment costs are expected to be generally similar or represent a relatively small increase compared to the Town-Only scenario. For example, accepting the Town of Carrboro's waste under a regional scenario, means these costs can be amortized over the larger waste acceptance quantities and the Town would be able to allocate a representative portion of the costs to the Town of Carrboro. Furthermore, by sharing the up-front capital costs and risk promotes a stronger commitment from the involved regional partners to continue participation throughout the facility's life cycle. As shown in Exhibit 7-7, this example of a regional approach yields a lower break-even tipping fee and, assuming

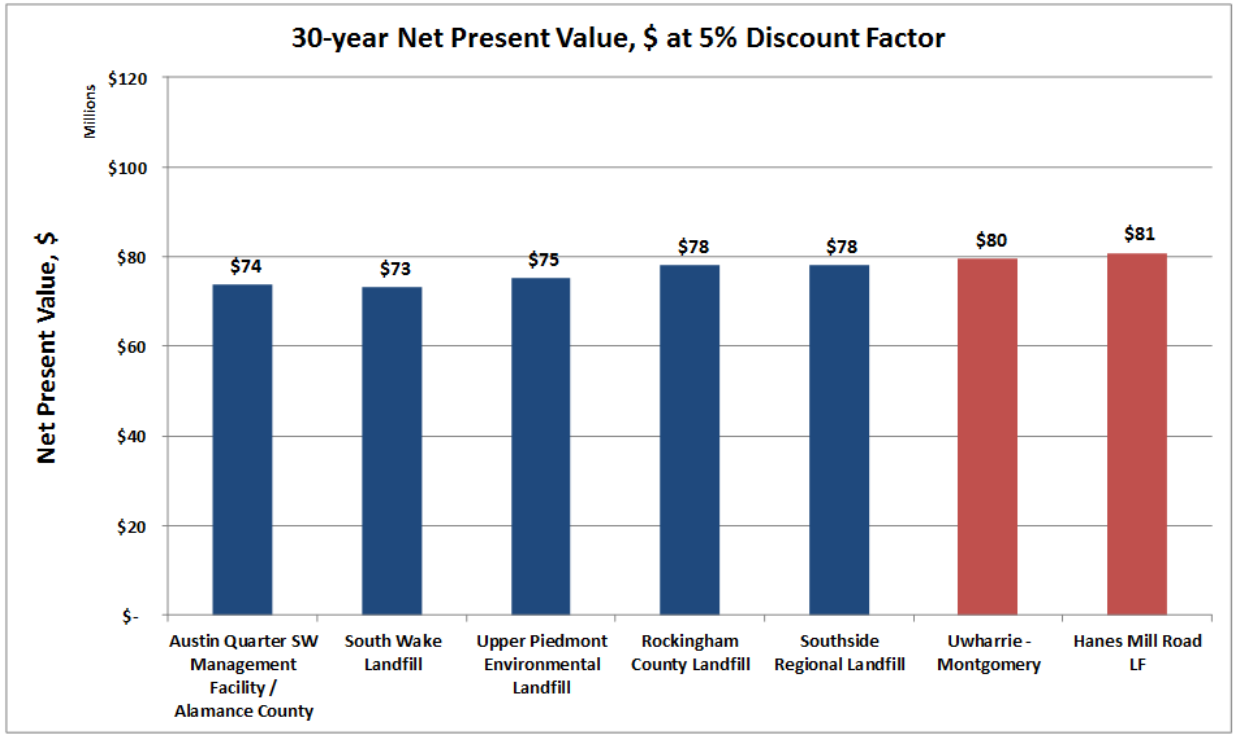
Exhibit 7-8. Summary of New Transfer Station Scenarios

Program Scenario A	Current	A	B	C	F	G	H	I
	DH to OCLF	New TS:TS to LF	New TS:TS to LF	New TS:TS to LF	New TS:TS to LF	New TS:TS to LF	New TS:TS to LF	New TS:TS to LF
Disposal Facility Name	Orange County LF	Austin Quarter SW Management Facility / Alamance County	South Wake Landfill	Upper Piedmont Environmental Landfill	Rockingham County Landfill	Southside Regional Landfill	Uwharrie - Montgomery	Hanes Mill Road LF
Transfer Miles								
Transfer Miles, one-way	6	17.5	40	46	75	78	85	85
Tansfer Miles, roundtrip	12	35	80	92	150	156	170	170
Average Transfer Speed, mph	35	50	50	50	50	50	50	50
2014 Budget Results- 2013 Budget Results								
TOWN SOLID WASTE BUDGET								
Collection Personnel Services								
Salaries - Full-Time	(1,389,100)	47,600	47,600	47,600	47,600	47,600	47,600	47,600
Other Pay	(1,900)	100	100	100	100	100	100	100
Workers Comp Insurance	(51,800)	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Subtotal, Collection Personnel Services	(1,642,800)	49,200	49,200	49,200	49,200	49,200	49,200	49,200
Collection Operating Expenses								
Personnel Agency Payments	(9,000)	300	300	300	300	300	300	300
Business Meetings & Training	(4,600)	100	100	100	100	100	100	100
Advertising	(2,500)	100	100	100	100	100	100	100
Uniform Rentals	(12,500)	400	400	400	400	400	400	400
Landfill Fines	(2,500)	100	100	100	100	100	100	100
Charges by Landfill	(674,000)	**(265,200)**	**(394,900)**	**(350,600)**	**(296,800)**	**(304,800)**	**(379,100)**	**(330,000)**
MSW	(669,500)	(267,600)	(397,300)	(353,000)	(299,200)	(307,200)	(381,500)	(332,400)
Yard Waste	(4,500)	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Fleet Use Charges	(300,000)	**6,500**	**6,500**	**6,500**	**6,500**	**6,500**	**6,500**	**6,500**
Fleet Use Charges	(293,000)	6,500	6,500	6,500	6,500	6,500	6,500	6,500
Supplies	(49,000)	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Fuel	(100,500)	**3,600**	**3,600**	**3,600**	**3,600**	**3,600**	**3,600**	**3,600**
Vehicle Fuel	(96,500)	3,600	3,600	3,600	3,600	3,600	3,600	3,600
Subtotal, Operation Expenses	(1,653,800)	**(252,600)**	**(382,300)**	**(338,000)**	**(284,200)**	**(292,200)**	**(366,500)**	**(317,400)**
NEW PROGRAM ALTERNATIVES								
Transfer Station & Hauling		720,000	851,000	866,000	938,000	946,000	1,116,000	1,116,000
Transfer Station		560,000	560,000	560,000	560,000	560,000	560,000	560,000
Hauling Operations		160,000	291,000	306,000	378,000	386,000	556,000	556,000
Subtotal, New Program Alternatives		**720,000**	**851,000**	**866,000**	**938,000**	**946,000**	**1,116,000**	**1,116,000**
		-	-	-	-	-	-	-
TOTAL BUDGET, COLLECTION AND DISPOSAL	(3,295,600)	516,600	517,900	577,200	703,000	703,000	798,700	847,800
Contingency, 25% on Additional Collection Costs		14,800	14,800	14,800	14,800	14,800	14,800	14,800
Total Potential Additional Costs (Savings)		**531,400**	**532,700**	**592,000**	**717,800**	**717,800**	**813,500**	**862,600**

This Table calculates the difference between current practices and the various scenarios for FY 2014 and compared to current FY 2013 budget.

Exhibit 7-9. Net Present Value of Town-Only Transfer Station

Live
A



Major Program Assumptions

Vegetative Waste	
Deliver to OCLF	Yes
Develop new VWP facility	No
Commercial Collection Decisions	
Privatize Commercial Collection (Yes/No?)	No
Year to Privatize Commercial	0
Keep Commercial-Business (Yes/No?)	Yes
Keep Multi-Family Collection (Yes/No?)	Yes
Year if Privatize Commercial	2014
Automation Decisions	
Begin Phase I Purchase of Automation, (Yes/No?)	No
Begin Phase I Purchase of Automation, Year	2013
Begin Phase II Automation (Yes/No?)	No
Begin Phase II Automation Year	2015
PAYT	
PAYT Program? (Yes/No?)	No
PAYT MSW Reduction, %	0
Fiscal Year to Implement PAYT	2015
Organics Diversion Program	
Organics Diversion Program? (Yes/No?)	No
Organics Diversion Program Begin, Year	2015
New Landfill	No
New Landfill, Town Only	No
New Landfill, Regional	No
Year to Construct	2018
Year to Operate	2019

approximately one-third of the costs are allocated to the Town of Carrboro, should enable the Town of Chapel Hill to save over $100,000 per year.

7.3 CONCLUSION AND RECOMMENDATIONS

As noted above, siting and developing a new Town-only transfer station would be challenging for a number of reasons and the scenarios reflecting direct haul to an existing transfer station located in an adjacent municipality provide a lower cost option, in part due to economies of scale. Developing a new regional transfer station provides for better economies of scale, but would face the same difficulties. SCS recommends that the Town pursue further evaluation for developing its own transfer station, and continue to participate in potential future regional cooperative efforts in this regard.

7.3.1 Recommendations

7.3.1.1 Pursue Siting and Permitting a Transfer Station Within the Town

Two major reasons to engage in efforts to develop a transfer station within the Town is the ability to control which facility the Town's waste is transferred to and to guard against price increases that could be imposed by neighboring transfer station facilities in the future. Recognizing that Town values (e.g., sustainability, local control of destination and price, and self-reliance, etc.) factor into these disposal option considerations, the scenarios that incorporate a new transfer station are attractive even though they may not represent the absolute lowest-cost option.

Another reason to engage in efforts to develop a transfer station is that future waste processing and treatment technologies that may be developed and implemented for the Town or elsewhere in the region will likely necessitate that the Town's waste be delivered to a central location, sorted in some manner, and transferred to larger trailers for transport to such future facilities. Furthermore, WTE facilities will generate waste that must be transferred for final disposal and this could act as a secondary backup to those facilities. Developing a transfer station now places the Town in a preferable situation to capitalize on future opportunities for innovative waste management and treatment techniques that may become available in the Town or in the surrounding region.

As noted previously, the efforts to permit a transfer station will likely require significant work over a multi-year period. SCS believes the Town would be well-served to commence preliminary planning activities, perform a technical feasibility study on the potential candidate sites (one being the Town-owned parcel located southeast of the intersection of Millhouse Road), and solicit interest from other municipal partners, specifically Town of Carrboro. Also, it is suggested that the Town staff and elected officials visit one or more existing transfer stations to observe conditions and operations.

7.3.1.2 When to Implement?

The impacts to this disposal scenario were evaluated with regard to the timing of accomplishing the development of a new transfer station. The timeframes considered involved:

- Immediately pursuing transfer station development implementation. This would involve investing in the necessary pre-development and capital construction costs now (during FY 2012-13 and FY 2013-14); and,

- Implementing a transfer station at some future date (well after the closure of the Orange County Landfill in 2013).

As noted, the financial analysis suggests that the scenarios reflecting direct haul to an existing transfer station located in an adjacent municipality provide a lower cost short-term option than developing a new Town-Only transfer station. Furthermore, the timeframe constraints to develop a new transfer station preclude it as a viable short-term option. However, several important intangible factors warrant ongoing evaluation of this disposal scenario to determine its value as a long-term option in the context of the Town's values and planning.

7.4 OTHER CONSIDERATIONS

Apart from this analysis of the impact to the SWSD budget, several other factors weigh into the longer term evaluation of developing a new transfer station. These considerations are not as readily quantified with respect to fiscal impact since they relate to risk management, environmental impacts, and socio-economic issues. However, these factors have the potential to create financial implications and indeed resonate with the Town's stated values and goals and must be considered along with the financial evaluation. Several of the more decisive factors include:

- Improved safety of the Town solid waste collections staff hauling waste shorter distances and over less heavily traveled roadways when compared to the direct haul scenarios;

- Similarly, with the shorter distances traveled compared to other waste disposal options, less fossil fuel is consumed, likewise resulting in relatively lower greenhouse gas emissions;

- A desire to manage Town-generated waste internally and not having to rely on a neighboring disposal system, thus maintaining control over ultimate disposal location and costs;

- Operating a Town-owned transfer station provides greater flexibility to evaluate and pursue alternative waste disposal options (i.e., waste conversion, waste-to-energy) as discussed in Section 12;

- A Town-owned transfer station enhances opportunities to expand other solid waste service offerings (i.e., Town-operated recycling, mulching/composting, organics processing, etc.);
- Compared to other options, a Town-operated transfer station provides greater control in meeting and improving the Town's waste reduction goals;
- Environmental and social justice issues when siting a transfer station; and,
- Long-term job creation and retention impacts with the development and operation of a new transfer station.

8.0 DISPOSAL OPTION – PAY-AS-YOU-THROW

Pay-As-You-Throw, commonly called PAYT, is a solid waste rate strategy that charges households solid waste collection and disposal fees commensurate with the amount of waste they place curbside for collection or transport to a disposal facility. Simply stated, the more waste a household produces, the more the household must pay for service. Appropriately-priced PAYT programs create a financial incentive for consumers to produce less waste, and thereby promoting improved reduction, re-use, and recycling.

The amount of waste is typically measured and billed according to a volumetric measurement (i.e., cubic yards, per bag, per bin); however, some PAYT programs measure waste by weight (i.e., pounds or tons). A volumetric measurement is the most common measurement due to the variation inherent to the weight of various waste streams, as this variability impacts capital cost recovery from the program capital cost.

According to national statistics, PAYT programs have been implemented in more than 7,100 communities across the U.S.[9] North Carolina Department of Environment and Natural Resources (NCDENR) records more than 30 North Carolina communities participating in a PAYT program. Notably, of these communities, only four counties in North Carolina use weight of waste as a measurement for their PAYT program.[10]

8.1 PAYT APPROACHES

PAYT systems can take many forms. Rate structures and the type and size of containers are often related, and combinations of techniques are often used.

8.1.1 Bag Programs

Households purchase specially marked bags that must be used to set out waste on collection day or for acceptance at the disposal facility. The annual cost to the resident is directly proportional to the number of bags purchased and used. This approach is used by several North Carolina counties for the collection of waste in unincorporated areas either through curbside collection or drop-off programs at convenience centers. These PAYT bag programs are currently operated in:

- Alamance County
- Alexander County
- Buncombe County
- Catawba County
- Mitchell County
- Onslow County
- Randolph County
- Union County
- Wilkes County

The advantages and disadvantages of PAYT bag programs are presented in Exhibit 8-1.

9 Ecoconservation Institute, http://www.paytnow.org.
12 NCDENR PAYT, http://infohouse.p2ric.org/ref/01/00365.pdf

Exhibit 8-1. Advantages and Disadvantages of a PAYT Bag Program[11]

Advantages	Disadvantages
Easy to understand.	Greater revenue uncertainty. Fluctuation based on bag sales.
Promote a stronger reduction incentive as fees are based on smaller waste increments.	Additional labor and management expense to sell bags.
Lower accounting and management cost as no billing system is needed.	Customers may perceive bags as an inconvenience. Purchase, storage, and transition from cans.
Lower distribution, storage, and inventory cost.	Bags are more expensive than tags or stickers.
Collection is often faster than non-automated collections.	Incompatible with automated and semi-automated collection systems.
Bags can be used to accommodate payment for bulky waste, white goods, etc. by attaching bags to the item for collection.	Bags are more susceptible to damage, tearing, etc.
Opportunities for capturing other revenue through advertising.	Bags are not re-used, adding to disposal volume.
	Bags are subject to overstuffing which causes tears, handling problems, and injury issues for collection staff.

8.1.2 Sticker or Tag Programs

PAYT sticker and tag programs are similar to the bag system in that residents purchase special tags or stickers that are affixed to each can, bag, bundle, or bulky item to be collected or directly disposed by the resident at the disposal facility. PAYT sticker and tag programs are currently operated in:

- Craven County
- New Bern
- Dover
- Jones County
- Madison County
- Transylvania County
- Yadkin County

The advantages and disadvantages of PAYT sticker/tag programs are presented in Exhibit 8-2.

11 "Analysis of Implementing a Pay-as-you-Throw", R.W. Beck, May 11, 2005.

Exhibit 8-2.
Advantages and Disadvantages of a PAYT Tag/ Sticker Program[12]

Advantages	Disadvantages
Easy to understand and less expensive to implement than bag or can programs.	Greater revenue uncertainty. Fluctuation based on tag/sticker sales.
Promote a stronger reduction incentive as fees are based on smaller waste increments.	Additional labor and management expense to sell tags/stickers.
Lower accounting and management cost as no billing system is needed.	Customers may perceive tags/stickers as an inconvenience.
Lower distribution, storage, and inventory cost.	Tags/stickers are subject to weather impacts (e.g., adherence problems).
Customers have a choice to tag/sticker their container of choice (i.e., bag or can).	With a choice of container size, clear limits and rules for disposal (i.e., size, weight) must be established and enforced.
Tags/stickers can be used to accommodate payment for bulky waste, white goods, etc. by attaching bags to the item for collection.	Collections are potentially slowed by checking for tags/stickers and managing enforcement.
	Tags/stickers are susceptible to vandalism and theft.
	Tags/stickers are not as noticeable as other PAYT methods.

8.1.3 Variable Can or Subscribed Can Programs

In this system, households register for a specific size of container or number of containers in which to place their household MSW depending on their estimated waste generation. Typical container sizes are either 64 or 96 gallons. A collection and/or disposal fee is charged commensurate with the container size or the number or containers. Under this scenario, the household gains control in choosing the waste disposal volume (and related cost) that best suits their historical disposal habits. Variable can programs are currently operated in:

- Eden
- Hendersonville
- Wilmington

The advantages and disadvantages of PAYT can programs are presented in Exhibit 8-3.

12 "Analysis of Implementing a Pay-as-you-Throw", R.W. Beck, May 11, 2005.

Exhibit 8-3.
Advantages and Disadvantages of PAYT Can Programs[13]

Advantages	Disadvantages
Program revenues are relatively stable and easier to forecast.	Potentially higher implementation costs if providing containers/cans.
Collection carts/cans are compatible with automated and semi-automated collection vehicles.	Less incentive to reduce waste disposal as customers have already subscribed to a fixed volume and are inclined to fill up.
Containers may be labeled, tagged, or installed with RFID chips for tracking, inventory, billing, and enforcement.	Billing and tracking systems are relatively more complex to manage various container sizes.
Existing containers may be applicable for use.	Storage and inventory systems and infrastructure necessary to manage cans.
	Can programs do not transition as easily to manage bulky waste and white goods.
	Customers may have difficulty selecting an appropriate subscription level.
	Challenges with the number of containers a customer may use and set-out for collection.

8.1.4 Hybrid Programs

This is an approach to PAYT that typically blends any of the above rate structures. In this system, households only pay for waste beyond a specified "base" set out volume. They pay a fixed bill or a tax bill that entitles them to a first container, can, or bag (or set number of bags). Then, additional waste is charged on a per bag, per sticker, or per cart system as described above.

The advantages and disadvantages of hybrid PAYT programs are presented in Exhibit 8-4.

13 "Analysis of Implementing a Pay-as-you-Throw", R.W. Beck, May 11, 2005.

Exhibit 8-4.
Advantages and Disadvantages of Hybrid PAYT Programs[14]

Advantages	Disadvantages
Helpful in transition from a traditional rate structure to a variable rate structure.	Least incentive for waste reduction.
Mitigates revenue risk by retaining some traditional financing methods.	Full costs of waste collection and disposal program may not be entirely reflected on customers.
Allows more time for customers and implementers to get familiarized with variable systems.	Potential confusion may be created in variable billing methods (e.g., per can and per bag).
Customers and implementers are not committed to a specific system.	
Relatively quick implementation and readily modified or replaced with other variable methods.	
No new billing systems may be needed.	
Allows time for planning and data collection.	

8.2 FINANCIAL ANALYSIS – PAYT RATES

A PAYT module was developed as part of the Pro Forma model to assist in the evaluation of potential cost savings and various collections and disposal rate structures that could result from implementation of PAYT.

8.2.1 Calculation of Baseline Collection and Disposal Cost

SCS analyzed the Town's solid waste management costs and tonnages based on the budget information provided. Within this analysis, cost and corresponding waste tonnage was allocated to either residential or commercial operations. From these data, SCS estimated the baseline residential collection and disposal cost per household, assuming that 11,500 households are served by the Town as described in Section 2. For the purposes of this evaluation, the residential collection and disposal cost per household includes both the current MSW and yard waste programs (i.e., one MSW collection and one yard waste collection per week), but does not include the costs to implement a recycling program alternate from the services currently provided by Orange County. Based on the information provided, the estimated monthly collection and disposal cost, per household, is $16.60 as presented in Exhibit 8-5.

14 "Analysis of Implementing a Pay-as-you-Throw", R.W. Beck, May 11, 2005.

Exhibit 8-5. Collection and Disposal Cost Per Household

Description	Cost
Personnel Services	$1,297,192
Operating Expenses	$1,016,414
Capital Outlay	$0
Revenues	($23,369)
Total	$2,290,238
Residential Costs:	
Waste Collection Cost/Household	
Annual	$199.15
Monthly	$16.60
Waste Collection Cost/Ton	$234.90

SCS used the PAYT Pro Forma module and this baseline cost to evaluate three (3) separate PAYT scenarios deemed most applicable to the Town's solid waste systems.

8.2.2 Option A – Variable Can Program

Residential customers receive a base level of service of one 64-gallon cart, along with yard waste collection and County-provided recycling. Smaller and larger cart sizes may be made available (e.g., 32 and 96-gallon). The billing rates proposed for these alternative subscription levels are based on the anticipated disposal costs of the reduced or excess volume of waste.

8.2.3 Option B – Modified Subscribed Can Program

Residential customers receive a base level of service of one 64-gallon cart, along with yard waste collection and County-provided recycling. Smaller and larger cart sizes may be made available (e.g., 32 and 96-gallon). The rates for the alternative subscription levels are based on the calculated ratio of the 64-gallon cart against alternative cart sizes. In other words, a 96-gallon cart holds 33% more waste volume than a 64-gallon cart, therefore, the subscription rate is 33% higher. The PAYT Pro Forma module allows, however, for the user to input any cost allocation as desired for the variable sizes.

8.2.4 Option C – Hybrid Program: Subscribed Can and Bag

Residential customers receive a base level of service of one 64-gallon cart, along with yard waste collection and County-provided recycling. A per-bag (or tag/sticker) fee is charged for additional bags generated above the base 64-gallon service. This per bag fee of $1.00, for the purposes of modeling, is based on review of several EPA and NCDENR studies[15] and includes

15 http://www.epa.gov/osw/conserve/tools/payt/pdf/payasyou.pdf
http://infohouse.p2ric.org/ref/01/00365.pdf
http://www.epa.gov/osw/conserve/tools/payt/pdf/sera06.pdf

the cost of the bag itself and the costs for disposal of its contents. The Pro Forma module allows the user to set this value at any level desired.

Exhibit 8-6 summarizes the PAYT scenarios developed using the module.

Exhibit 8-6. PAYT Scenarios

	Monthly Subscription	Option A	Option B	Option C
Description of Scenario	Residential customers pay a monthly fee and receive one 64-gallon cart.	Customers pay a monthly fee depending on the cart size selected. Monthly fee is based on the disposal costs of additional (or reduced) volume generated.	Customers pay a monthly fee depending on the cart size selected. Monthly fee is based on a selected ratio of alternative cart size to the base cart size.	Residential customers pay a monthly fee and receive one 64-gallon cart. A per-bag fee is charged for additional bags.
Monthly Base Rate per Household ($)	$16.50	32-gal: $13.69 64-gal: $16.58 96-gal: $19.57	32-gal: $11.14 64-gal: $16.58 96-gal: $22.12	$16.58
Annual Fee per Household ($)	$198.00	32-gal: $164.28 64-gal: $198.96 96-gal: $234.84	32-gal: $133.68 64-gal: $198.96 96-gal: $265.44	$198.96
Per-Bag Fee ($)	N/A	N/A	N/A	$1.00
Assumed Number of Customers(1)	11,500	32-gal: 1,060 64-gal: 8,480 96-gal: 1,060	32-gal: 1,060 64-gal: 8,480 96-gal: 1,060	11,500
Total Bags Sold per Year (assumed)	N/A	N/A	N/A	11,500

Notes:
1. Customer participation is calculated by: (Total # of Households – Collection Exemptions) * 10% at 32 gal., 80% at 64 gal., and 10% at 96 gal. Assume 900 household exemptions.

8.2.5 Financial Modeling Assumptions

The PAYT Pro Forma module allows the Town to modify many of the assumptions used and develop revised rates as the PAYT program matures. Assumptions used for the above modeling includes:

8.2.5.1 Waste Reduction

Data from more than 1,000 communities around the country was used to identify the impacts of PAYT above and beyond any other recycling or yard waste program differences, demographics, and other factors. The research showed the following impacts on residential solid waste:[16]

- MSW disposal tonnages typically decrease by 16 to 17%. This decrease is generally comprised of the following components:

16 Skumatz Economic Research Associates, Inc. (SERA) 2006, Pay As You Throw (PAYT) In The US: 2006 Update And Analyses, http://www.paytnow.org/PAYT_EPA_SERA_Report2006G.pdf.

- Gains in the solid waste recycling ratio of 5 to 6 percentage points or 5 to 6% of residential waste generation;
- Increases in yard waste diversion of about 4 to 5 percentage points; and,
- Source reduction of about 6% of generation.

For this module, a 17% reduction in waste was assumed from the implementation of PAYT. Accordingly, recycling was assumed to increase 5.53%, yard waste diversion was assumed to increase 5.53%, and source reduction was assumed to increase 5.95%. As seen in the data from these communities, gains in each of these metrics are attributed to the customer recognizing their disposal habits, once they are required to pay for these services, and diverting waste to established recovery programs (i.e., recycling, yard waste, etc.) that they would have otherwise thrown away at no cost.

8.2.5.2 Levels of Service

It is difficult to predict how many households will choose a particular level of service and often households will change service levels as the program matures. Often the waste collections entity (public or private) will allow one service-level change for "free," and limit future changes to an annual basis while charging a fee to do so. For this level of modeling, SCS has assumed that 900 of the 11,500 Town households maintain a collections exemption and the remaining 10,600 residential customers would choose the following levels of service:

- Percentage of customers choosing smaller can (i.e., 32-gallon): 10%.
- Percentage of customers choosing larger can (i.e., 96-gallon): 10%.
- The remaining 8,480 customers would select the base level of service (i.e., 64-gallon).

These service-level assumptions can be changed in the Pro Forma module for additional modeling scenarios.

8.2.5.3 Cart Costs

SCS assumed that the Town would be required to purchase additional carts for those residential customers selecting an alternative level of service. For the purposes of modeling these scenarios, SCS assumed that the new cart costs would average $50 per cart and would be amortized at 4% for 7 years. Again, these baseline assumptions can be changed accordingly.

8.2.5.4 PAYT Coordinator

Communities that have implemented PAYT have often designated or hired a program coordinator to:

- Communicate with the public (e.g., program publicity, community outreach, hearing complaints, and coordinating subscription changes).

- Track waste disposal tonnage results and costs.
- Coordinate with existing waste collection and recycling programs.
- Order and distribute carts.
- Implement and manage bag programs, as necessary (e.g., order bags, sell bags, coordinate with retailers).

For the sake of conservatism and for the purposes of this analysis, it was assumed that the Town would hire a PAYT coordinator. Associated salary and FTE assumptions have been included in the Pro Forma module and can be adjusted by the Town accordingly.

8.2.5.5 Bag Set Out Levels

The revenue associated from bag set outs is difficult to predict. It was assumed that 10% of homes would set out 1 additional bag per week, 10% of homes would set out 2 additional bags per week, 10% of homes would set out 3 additional bags per week, and 10% of homes would set out 4 additional bags per week. These set outs can be modified by the Town.

8.2.5.6 Revenues

PAYT programs, because they depend on customer behavior choices, will inherently lead to more volatile revenue streams than systems with fixed bills. Revenues are no longer based on a stable number like households, but rather on the number of individual bags or levels of cart services selected by homeowners. The number of bags disposed can vary month-to-month and week-to-week. The PAYT module attempts to define the amount of revenue required to operate the Town's base program and offers an estimate of the revenue excess/shortfall created by the particular PAYT scenario.

8.3 IMPLEMENTATION – LESSONS LEARNED

Based on interviews with hundreds of communities nationwide that have implemented PAYT, Skumatz Economic Research Associates, Inc. (SERA), and the Econservation Institute (Institute) have assembled the following tips that the Town may wish to consider:[17]

- **Pilot test.** Consider implementing the program in one area of the Town first, and then spread to other areas. Learning lessons about subscriptions, set outs, containers, and other problems in a limited part of the Town can provide important information prior to full implementation.
- **Billing.** Billing for solid waste services jointly with other municipal-provided services, if possible, can provide strong advantages. If the ordinance is arranged so that partial payments are assigned to solid waste first, then non-payments for solid

17 Lisa A. Skumatz, Ph.D., Skumatz Economic Research Associates, Inc. (SERA), found at: http://www.paytnow.org/PAYT_CO_faqpaytSERA_v6.pdf

waste services can lead to impacts or even temporary termination of these other services, a strong payment incentive. Bad debt is quite low under these systems.

- **Involve others in design.** Assembling a citizen or stakeholder committee to help assess and design the program can help sell the program to elected officials, and can make sure that the program addresses concerns of major stakeholders. Although this process may appear to slow down the decision-making, it can often speed it in later steps and can bring support for the program when it is most needed. Related Town departments, including financial, billing, enforcement, customer service, police, and others that may be affected by PAYT changes should be included in discussions.

- **Don't pile on other costs.** The Institute cautions against implementing PAYT along with other major program changes (e.g., major renovation to transfer stations or other upgrades that are not invisible to residents). The increased costs, whether or not they are due to PAYT, will most likely be blamed on PAYT and will potentially undermine the buy-in for the program.

- **Determine whether to make changes at once or more slowly and design education accordingly.** Some communities argue that implementing many changes at one time confuses citizens and makes the education process difficult. Others argue that customers don't want to have to make decisions about solid waste in a piecemeal manner, and want to "deal with it once."

- **Education and outreach.** None of the communities interviewed during SERA's research wished they had done less education. Education and community outreach is a crucial component of a successful PAYT program.

- **Keep constant for one year.** If at all possible, keep the system and rates constant for at least one year to help build confidence in the program. After evaluation of this initial year of service, the rates and program can be refined to account for unexpected outcomes.

- **Tracking/Revising.** It is important to track key indicators related to the program and its performance to assure that the PAYT program is achieving its objectives and that the program is sustainable. Key metrics and indicators to track include:

  - Container subscriptions, or sales of bags and/or tags
  - Program enforcement issues
  - Program revenues and costs
  - Time spent by various program staff
  - Waste tonnage changes by programs, etc.

  The Town may use this valuable information to gauge program progress, cost-effectiveness, and to provide advance notice for needed programmatic changes.

- **Keep key groups informed.** Provide regular feedback to program staff, elected officials, and others to keep them informed about program momentum and successes,

including the monitoring statistics referenced above. Note problems and corrective actions, to demonstrate the program staff has a handle on the program and are making sure it is on track and as efficient and effective as possible.

8.4 CONCLUSIONS AND RECOMMENDATIONS

During review and analysis of the Town budget for this Comprehensive Study, these analyses indicated the Town currently does not directly charge its residents for solid waste disposal. Reimbursement to the Town for SWSD costs incurred for residential solid waste management is understood to be included in the Town's general tax base. However, some direct revenue is allocated to the SWSD program through Commercial collections, collection cart sales, bulk waste and white goods collection, and customer fines. With the results of this PAYT analysis, the Town may begin to consider allocating the costs of its SWSD residential waste collection services, or a portion thereof, directly to its customers in accordance with the above suggested rates.

In consideration of the current SWSD management structure, existing collections equipment and resources, collections practices, and an understanding of the Town culture; if the Town is inclined to reallocate these costs from the general tax base directly to its residents, this analysis indicates that a hybrid PAYT program would likely be the most appropriate approach. In consideration of a hybrid program, a Subscribed Can and Bag, or Subscribed Can and Tag program are most applicable to the Town for the following reasons:

- Of all the PAYT program options, a hybrid program presents the easiest transition to PAYT programs from more traditional solid waste financing methods.
- The majority of Town residents currently use appropriate cans (i.e., 64-gallon carts) and the Town maintains an existing inventory, maintenance, replacement, and billing system to issue new cans and/or replace damaged cans.
- The Town currently utilizes semi-automatic collection vehicles to service the cans. Thus implementation of a dedicated bag or tag only system is not appropriate.
- Robust recycling and yard waste programs are currently engaged throughout the Town program and accordingly the Town currently achieves commendable solid waste diversion statistics. Thus the inherent incentives towards greater diversion promoted by other PAYT methods are not deemed to be a significant driver for PAYT implementation.
- The Town currently shares a majority of the costs to implementing solid waste services without directly encumbering its residents. Similarly, Town residents appreciate the solid waste service they receive and if asked, are likely willing to pay directly for a portion of this service if it would not impact the level of service. A hybrid PAYT method would promote a smoother transition to such cost sharing versus other methods.

- A bag or tag program would assist the Town in assessing appropriate billing for bulky waste collection and white good collection. Bags or tags may be purchased in accordance with the current published fee structure for these programs. For example:

  - $10 for three (3) tags or three (3) bags;

  - $5 for each additional tag or bag; and,

  - Bulky waste and white goods would be tagged or tied with a bag to indicate payment is received and authorized for collection. SCS suggests a fee of $10 per bulky item sticker.

- Transitioning to a PAYT program in this manner introduces the program subtly. Subsequently, the Town may begin to employ a bag or tag requirement for excess waste placed alongside the Town-issued cart.

- Development of an enhanced billing system for cans, bags, and/or tags is not immediately necessary, but SCS recommends the Town evaluate options to accommodate billing and recovery activities associated with the PAYT program. The Town may continue to provide residential can collections utilizing the existing tax structure, while charging customers for bags/tags purchased at municipal offices, other retail locations, via internet, etc.

- The Town should consider hiring or assigning a PAYT coordinator (assumed to represent a cost of $45,000 per year).

- SCS estimates that an additional 2,100 carts would need to be purchased at an average cost of $50/cart (mix of 32-gallon and 96-gallon carts) to accommodate lower and higher generators, for a capital cost of $106,000.

A phased transition to PAYT allows the Town time to further evaluate other solid waste program changes, continue to gather data, and familiarize itself with these programs while affording the least service disruption to its customers.

9.0 DISPOSAL OPTION – SITE/ CONSTRUCT A NEW MATERIAL RECOVERY FACILITY

9.1 EVALUATE DEVELOPMENT OF A NEW MATERIALS RECOVERY FACILITY

SCS evaluated the feasibility and assessed the potential benefits of the Town developing a new Town-only materials recovery facility (MRF). A MRF is generally described as a facility that accepts source-separated materials for purposes of recovering recyclable materials which will be transported to secondary markets for reclamation or processing. Waste collection vehicles unload recyclables or select wastes that are believed to have some reclamation value onto a tipping floor where they are sorted and segregated. For further distinction, a "dirty" MRF is a transfer station that receives nonsegregated solid waste, sorts and separates the waste into recoverable and disposable materials, and processes these materials accordingly.

The analysis provides the following:

- Summary of the challenges and obstacles to siting a new MRF in the Town.
- Summary of the benefits of siting and operating a MRF in the Town (e.g., potential increase in materials that can be recycled and the decrease in disposal costs).
- A cost estimate for the site selection, permitting, design, capital construction, and operation for a Town-operated MRF.

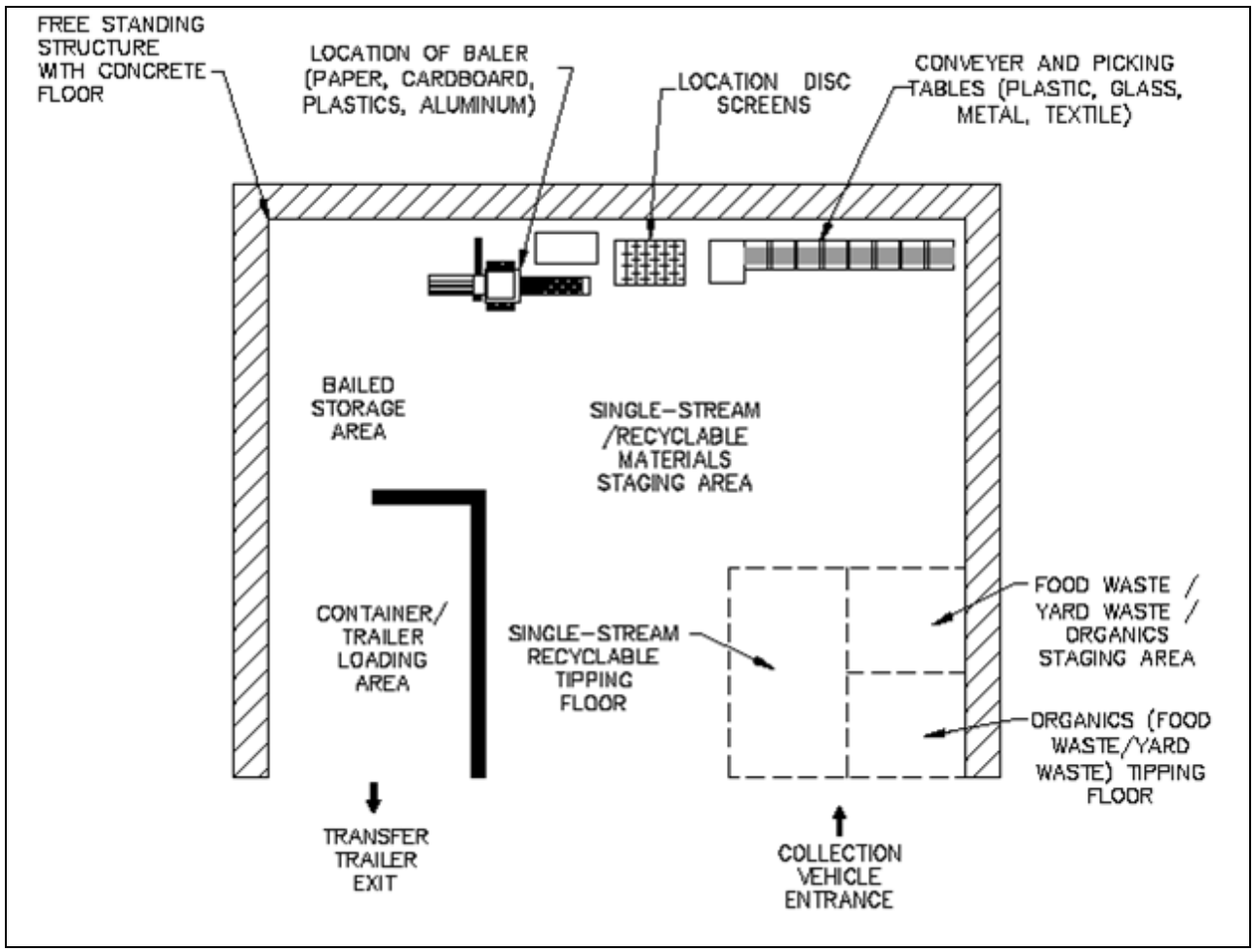
9.1.1 MRF Siting Challenges, Advantages, and Disadvantages

SCS and the Town recognize that there are two major obstacles to the construction and operation of a stand-alone MRF in order to receive and sort the waste materials generated within the Town that are suitable for recycling. The first is related to the costs associated with a MRF and the scale of operations necessary to achieve economic viability. Based on SCS's experience, a MRF typically requires an investment of several million dollars (even small MRFs usually cost in excess of $3 million). Typical minimum, stationary equipment required for a MRF include a conveyor, a mechanical materials sorter, various mechanical separators, and baler. An example schematic depicting a typical MRF operation and applicable equipment is presented in Exhibit 9-1.

9.1.1.1 Summary Economy of Scale

As documented in Section 2, the current recycling material quantities attributed to being generated within the Town is approximately 7,500 tons per year, of which approximately 41% (3,100 tons) comprises the urban curbside collection program and multi-family contribution, and 22% comprises the commercial food waste program. Another 20% of the Town's recycling material is collected at the remote drop-off sites and convenience centers and separate from the dedicated Orange County curbside collections; while another 10% comprises the commercial recycling contribution.

Exhibit 9-1. Example Schematic of a Typical MRF Operation



Recognizing that the commercial food waste portion is unlikely to be delivered to a MRF for sorting at this time, and participating residents using the current drop locations and convenience centers may not utilize the Town MRF location, this yields a potential throughput for a MRF in the range of 60 to 75 tons per week depending on participation, or approximately 20 to 25 tons per day (tpd) assuming materials are delivered only 3 days per week. The rationale for assuming delivery of recyclables 3 days per week is that this schedule correlates to using 4 dedicated routes per day averaging 5 tons per route to collect the 60 tons per week of recyclables that represents the urban curbside collection program and multi-family contribution. Recognizing that commercial sources contribute an additional 15 tons of recyclables per week, a total of 5 dedicated routes per day averaging 5 tons per route would be necessary to collect 75 tons per week, which represents traditional recyclables but excludes organic wastes that may be diverted.

Over a 20-year period, the Town's recycling material quantities (assuming a consistent per capita rate) are anticipated to increase to nearly 10,000 tpy, of which about 2,500 tons (25%) could potentially represent the commercial food waste portion. The remaining 7,500 tons per year is equivalent to 145 tons per week, or approximately 45 tpd assuming a 3-day per week schedule. These relatively small quantities do not facilitate economic viability of a stand-alone MRF to manage the Town's existing recyclable materials. As described in Section 2, for comparison, Orange County recently earned approximately $750,000 annual revenue from resale of its

marketable recyclables, equivalent to more than twice the quantity projected to be generated by the Town.

9.1.1.2 Competition from Current Orange County Recycling Program

The second obstacle is related to the existing recycling program that Orange County administers in which the Town currently participates. As described in Section 3, the current service level provided by the County is generally accepted to be above average and the current recycling programs are considered to be quite successful. The County has existing contracts with several entities to purchase recyclables and has implemented curbside single-stream recycling for residential customers in the Town that requires little to no sorting and processing that is typically associated with the need for a MRF.

The concept for a stand-alone MRF, owned and operated by the Town, would appear to necessitate that the Town assume control of its own curbside collections program in order that the collected recyclables are delivered to this facility, or reach some agreement with the County to deliver the recyclable materials to this new Town facility. However, the Town currently benefits from participation in the recycling programs administered by the County without the need for a stand-alone MRF. Furthermore, as presented in Section 3, the costs to implement a Town-only recycling collections program, excluding the materials processing and marketing costs attributed to a Town MRF, is approximately equivalent to the "total program" costs currently allocated to the Town by the Orange County program.

9.1.1.3 Advantages

Based on our experience, the following advantages are associated with developing a new stand-alone MRF within the Town's planning jurisdictional limits:

1. Potential to increase recycling rates and improve waste diversion rates of waste currently being managed at a disposal facility (i.e., landfill).

2. Accordingly, the Town would potentially recognize a reduction in waste disposal costs resulting from a reduced disposal volume and accompanying tip fees.

3. Opportunity to add new solid waste services or waste management practices dependent on segregated materials (e.g., mulching, composting, waste conversion technologies, etc.).

4. Opportunity to gain control over the ultimate disposition of Town-generated recoverable materials (i.e., where materials are taken, what materials are used for, and what market price these materials demand, etc.).

5. Potential to collaborate with neighboring municipalities, expand operations, and promote regional waste diversion goals, while potentially earning greater revenue.

9.1.1.4 Disadvantages

Based on our experience, the following disadvantages are associated with developing a new stand-alone MRF within the Town's planning jurisdictional limits:

1. Requires the Town to implement new policies and programs in order to direct recyclable materials collected by the current program to the new MRF. Operating a MRF without participation from neighboring municipalities, including Orange County, would potentially be counterproductive towards regional collaboration.

2. Economies of scale for a viable operation are dependent upon regional partners to commit delivery of recyclables to the new MRF in order to deliver a marginal return on investment at best. The Town and other regional partners would need to address the challenge of attempting to secure flow control of recyclables through passing multiple ordinances. The efforts associated with such collaboration would likely involve demonstrating to regional partners that the Town has established contract terms, purchase prices, and durations for sale of reclaimed materials within the secondary markets.

3. The recyclable materials market is a commodity market subject to potentially volatile fluctuations. Again, the risks associated with market volatility must be managed through strategic contract negotiations and attentive materials management.

4. Community opposition and potential perceived impacts to communities surrounding the MRF (e.g., noise and traffic), although modern MRFs employ mitigation measures that can reduce or eliminate these impacts. Siting a new stand-alone MRF within the Town limits, or the surrounding area, would be challenging, but is believed to be generally less contentious than a landfill.

5. Significant capital investment is required (see discussion below).

6. The Town will incur professional salary expenses and/or temporary labor expenses to hire and supervise personnel to operate the MRF.

7. Developing a new stand-alone MRF could require 2 to 3 years to complete. As such, it is not available as a short-term alternative to the Town in the near future.

9.1.2 Co-Locating MRF or Composting Facility With a New Transfer Station

SCS recommends that the Town consider the concept of co-locating a MRF in conjunction with a new transfer station as an alternative to a stand-alone MRF. Essentially, this concept is to plan and design a new transfer station to include capabilities for sorting incoming wastes and handling recyclable materials in designated areas of the facility. The Town is continuing to develop programs and services that embrace solid waste as a resource and enabling a new transfer station to be configured and equipped to sort incoming wastes for the purpose of diverting materials that have a recycling or reclamation value would appear to be more attractive than a stand-alone MRF or traditional MSW transfer station. Furthermore, another primary objective of a co-located facility would be to segregate materials from incoming wastes that are not currently

being recycled under the County's existing and planned recycling programs and thereby increase the quantities of waste that are required to be transferred to disposal facilities.

In the same manner, it is recommended that the Town also consider the concept of co-locating a composting facility in conjunction with a new transfer station that could be utilized to increase organics diversion rates.

Examples of existing MSW transfer station facilities that having some degree of recycling or composting capabilities (in other words, a standard MSW transfer station that is essentially "co-located" with a composting/vegetative waste facility or has "MRF-like" capabilities such as a baler, sorter, or anything else to enable recovery and processing of recyclables) are noted below:

- Recology Hay Road Composting/MRF in Dixon, CA
- Recology Yubb-Sutter Composting/MRF in Marysville, CA
- Community Waste Disposal in Dallas, TX
- Frederick County, MD
- Ocean City, MD
- Island County, WA

9.1.2.1 Sizing an Appropriate Facility

Hypothetical transfer station MRF and transfer station/composting facility dimensions and waste throughput quantities were developed based on a number of assumptions regarding the maximum daily waste acceptance rates for MSW, recyclables, and vegetative wastes, facility configuration, traffic flow patterns, and setbacks to the property line from the transfer station building footprint.

As noted in Section 7, assuming MSW collection occurs 4 days per week, 52 weeks per year, the daily MSW throughput quantities for a Town-only facility range from 75 tons per day (tpd) in FY 2014-15 to approximately 100 tpd in FY 2033-34.

- If the Town of Chapel Hill decides to construct a transfer station that incorporates a MRF to accommodate their MSW generation plus an area for processing and storing recyclables for the next 20 years, the facility should be sized to manage 150 tpd.

- Based on SCS's experience, a transfer station/MRF sized to handle 150 tpd of MSW and recyclables will require a building footprint in the 13,500 sf range, situated on a site pad of at least 2.5 acres within a total property parcel size equal to 5 acres to accommodate site access, truck queuing, and turning radius.

The Town currently collects approximately 2,500 tons per year of yard waste, which is anticipated to escalate to nearly 3,400 tons per year over the next 20 years.

- If the Town of Chapel Hill decides to construct a transfer station that incorporates a vegetative waste composting facility to accommodate their MSW generation plus an area for processing and composting organic wastes for the next 20 years, the facility should be sized to manage 140 tpd.

- Based on SCS's experience, a transfer station/compost facility sized to handle 140 tpd of MSW and organic wastes (yard waste and food waste) will require a building footprint in the 12,000 sf range, situated on a site pad of at least 4 acres within a total property parcel size equal to 6 acres.

- A facility that serves as a transfer station/MRF/compost facility sized to handle 200 tpd of MSW, recyclables, and organic wastes (yard waste and food waste) will require a building footprint in the 15,000 sf range, situated on a site pad of at least 5 acres within a total property parcel size equal to 7 acres.

9.1.3 Estimated Development Costs for Co-Located MRF or Composting Facility With a New Transfer Station

SCS prepared conceptual budget cost estimates for the construction and operation for both the transfer station/MRF and the transfer station/compost facility scenarios. The construction cost estimates include costs for siting, permitting, design, building construction, scalehouse and scales, sorting and separating equipment, maintenance facilities, utilities, entrance roads, transfer trailer staging area, and ancillary support facilities. The cost estimates do not assign any costs for land acquisition, which reflects an assumption that the facility will be located on an existing Town-owned property. Should the Town need to consider land acquisition costs in this analysis, these preliminary land acquisition costs are described further in Section 11 for the consideration of developing a Town landfill.

The cost estimates are based on SCS's experience working with municipal and private clients throughout the region, and were prepared to provide an order-of-magnitude estimate of the critical aspects of construction and operation of a transfer station that is specifically planned to enable aggressive efforts for recovering recyclable materials and/or organic materials from the incoming waste stream. If the Town were to develop a transfer station under either scenario, a more detailed estimate would need to be prepared based on actual site information. Exhibit 9-2 and Exhibit 9-3 present a summary of the estimated pre-development and capital construction costs to develop a new transfer station/MRF and transfer station/compost facility, respectively.

For conceptual cost estimating purposes, the capital costs for each scenario are amortized over the 30-year projection period at 4% interest to estimate the yearly allocated capital expenditure costs.

Exhibit 9-2. Estimated Cost to Develop a New Transfer Station/ Materials Recovery Facility

DESCRIPTION	UNIT	QUANTITY	LABOR MATERIAL & EQUIPMENT COST	SUBTOTAL	TOTAL
PRE-DEVELOPMENT COSTS					
Land Acquisition / Purchase	ac	5	$0	$0	
Permitting	ls	1	$150,000	$150,000	
Engineering, Legal, & Admin	ls	1	$475,000	$475,000	
					$625,000
CONSTRUCTION					
Mobilization/Demobilization	ls	1	$101,000	$101,000	
					$101,000
EROSION CONTROL					
Clearing and Grubbing	ac	5	$6,000	$30,000	
Erosion Control Measures	ls	1	$15,000	$15,000	
Site Restoration (seeding/mulching/vegetation)	ls	1	$10,000	$10,000	
					$55,000
BUILDING COSTS					
Site Work (Excavation, Grading, Paving, and Landscaping)	sf	108,900	$6.50	$707,850	
Utilities (Electrical, Water, Sewage, Storm water)	sf	13,600	$2.00	$27,200	
Structures (Concrete, Structural, Doors, Fire control, Lighting, Roof)	sf	13,600	$35.00	$476,000	
					$1,211,050
EQUIPMENT COSTS					
Conveyor & Sorter	ls	1	$125,000	$125,000	
Separator	ls	1	$40,000	$40,000	
Baler	ls	1	$150,000	$150,000	
					$315,000
OTHER SITE WORK					
Maintenance Building	ls	1	$15,000.00	$15,000	
Scalehouse	ls	1	$150,000.00	$150,000	
Office Equipment (computer, supplies, telephone, etc.)	ls	1	$7,500	$7,500	
Truck Scales	ls	2	$50,000.00	$100,000	
Site Lighting	sf	108,900	$0.50	$54,450	
Signage, Locking gate, Fencing	ls	1	$30,000	$30,000	
Construction Quality Assurance & Certification (third-party)	ls	1	$81,150	$81,150	
					$438,100
				TOTAL	**$2,745,150**
				CONTINGENCY (20%)	**$549,030**
				PRELIMINARY COST ESTIMATE TOTAL	**$3,294,000**

Compared to the estimated cost to develop a Town-Only transfer station, as presented in Section 7, the incremental cost to include MRF capability is estimated to be approximately $915,000. The majority of this incremental cost is attributed to additional equipment costs for materials processing, along with building costs for a larger building footprint necessary to process and manage the recoverable materials.

Exhibit 9-3. Estimated Cost to Develop a New Transfer Station/ Compost Facility

DESCRIPTION	UNIT	QUANTITY	LABOR MATERIAL & EQUIPMENT COST	SUBTOTAL	TOTAL
PRE-DEVELOPMENT COSTS					
Land Acquisition / Purchase	ac	5	$0	$0	
Permitting	ls	1	$150,000	$150,000	
Engineering, Legal, & Admin	ls	1	$475,000	$475,000	
					$625,000
CONSTRUCTION					
Mobilization/Demobilization	ls	1	$106,000	$106,000	
					$106,000
EROSION CONTROL					
Clearing and Grubbing	ac	6	$6,000	$36,000	
Erosion Control Measures	ls	1	$20,000	$20,000	
Site Restoration (seeding/mulching/vegetation)	ls	1	$15,000	$15,000	
					$71,000
BUILDING COSTS					
Site Work (Excavation, Grading, Paving, and Landscaping)	sf	174,280	$6.50	$1,132,820	
Utilities (Electrical, Water, Sewage, Storm water)	sf	12,000	$2.00	$24,000	
Structures (Concrete, Structural, Doors, Fire control, Lighting, Roof)	sf	12,000	$35.00	$420,000	
					$1,576,820
OTHER SITE WORK					
Maintenance Building	ls	1	$25,000.00	$25,000	
Scalehouse	ls	1	$150,000.00	$150,000	
Office Equipment (computer, supplies, telephone, etc.)	ls	1	$7,500	$7,500	
Truck Scales	ls	2	$50,000.00	$100,000	
Site Lighting	sf	174,280	$0.25	$43,570	
Signage, Locking gate, Fencing	ls	1	$35,000	$35,000	
Construction Quality Assurance & Certification (third-party)	ls	1	$100,445	$100,445	
					$461,515
				TOTAL	**$2,840,335**
				CONTINGENCY (20%)	**$568,067**
				PRELIMINARY COST ESTIMATE TOTAL	**$3,408,000**

Compared with Exhibit 9-2, the incremental costs to develop a co-located compost facility, rather than a MRF is estimated to be approximately $114,000. While developing a compost facility does not require capital investment in mechanical equipment, the additional acreage, site work, landscaping, and material handling equipment necessary to operate a composting operation offsets these capital expenditures.

9.1.4 Estimated Transfer Station/ MRF and Transfer Station/ Compost Facility Operations Costs

Exhibit 9-4 and Exhibit 9-5 present the estimated annual operation costs for the co-located transfer station/MRF scenarios and transfer station/compost facilities, respectively. The annual operational costs include personnel, and equipment needed to operate a transfer station/MRF and transfer station/compost facility. The annual operational costs also include an annual permit renewal fee ($1,500).

Exhibit 9-4. Estimated Annual O&M Cost for New Transfer Station/ Materials Recovery Facility Scenario

No.	Item Description	Quantity	Unit	Engineer's Unit Price Est.	Engineer's Total Estimate
1	Personnel Salaries	4	LS	$ 40,000	$ 160,000
2	Personnel Benefits	4	LS	$ 15,000	$ 60,000
3	Transfer Station Equipment Debt Service	4	LS	$ 15,000	$ 60,000
4	Transfer Station Equipment Maintenance / Repair	4	LS	$ 5,000	$ 20,000
5	Equipment - Lease/Rental	1	LS	$ 10,000	$ 10,000
6	Vehicle Fuel	10,000	Gal	$ 3.50	$ 35,000
7	Vehicle Supplies	1	LS	$ 7,500	$ 7,500
8	Wastewater Treatment	200,000	Gal	$ 0.03	$ 6,000
9	Paving / Concrete	1	LS	$ 7,500	$ 7,500
10	Electricity & Heating	1	LS	$ 12,500	$ 12,500
11	Water & Sewer	1	LS	$ 2,500	$ 2,500
12	Telecommunications / Information Technology	1	LS	$ 2,500	$ 2,500
13	Vehicle Insurance	1	LS	$ 2,500	$ 2,500
14	General / Environmental Insurance	1	LS	$ 1,000	$ 1,000
15	Engineering / Consulting Services	1	LS	$ 5,000	$ 5,000
16	Environmental Monitoring Services	1	LS	$ 5,000	$ 5,000
17	Legal Services	1	LS	$ 5,000	$ 5,000
18	Mowing & Other Contracting Services	1	LS	$ 2,500	$ 2,500
19	Dues & Association Fees	1	LS	$ 1,500	$ 1,500
20	Permit Fees	1	LS	$ 1,500	$ 1,500
21	Office Supplies	1	LS	$ 2,000	$ 2,000
22	Janitorial	1	LS	$ 1,000	$ 1,000
23	Operations & Maintenance Supplies	1	LS	$ 1,500	$ 1,500
24	Uniforms	1	LS	$ 1,000	$ 1,000
25	Miscellaneous Maintenance / Repair	1	LS	$ 7,500	$ 7,500
					$ -
	SUBTOTAL				$ 420,500
	CONTINGENCY (20%)				$ 84,100
	TOTAL ESTIMATED ANNUAL OPERATING COST				**$ 504,600**
	WASTE ACCEPTANCE RATE	150	tpd		
	ANNUAL OPERATING COST PER TON				$ 16.17

Compared to the estimated annual cost to operate a Town-Only transfer station, as presented in Section 7, the incremental cost to operate a MRF in addition to traditional transfer station operations is estimated to be approximately $162,600 per year. This incremental cost is attributed to the need for one (1) additional staff to assist in processing materials, annual debt service and maintenance costs for the additional equipment used in materials processing.

Exhibit 9-5. Estimated Annual O&M Cost for New Transfer Station/ Compost Facility Scenario

No.	Item Description	Quantity	Unit	Engineer's Unit Price Est.	Engineer's Total Estimate
1	Personnel Salaries	4	LS	$ 40,000	$ 160,000
2	Personnel Benefits	4	LS	$ 15,000	$ 60,000
3	Transfer Station Equipment Debt Service	4	LS	$ 20,000	$ 80,000
4	Transfer Station Equipment Maintenance / Repair	4	LS	$ 10,000	$ 40,000
5	Equipment - Lease/Rental	1	LS	$ 10,000	$ 10,000
6	Vehicle Fuel	12,000	Gal	$ 3.50	$ 42,000
7	Vehicle Supplies	1	LS	$ 5,000	$ 5,000
8	Wastewater Treatment	200,000	Gal	$ 0.03	$ 6,000
9	Paving / Concrete	1	LS	$ 7,500	$ 7,500
10	Electricity & Heating	1	LS	$ 5,000	$ 5,000
11	Water & Sewer	1	LS	$ 2,000	$ 2,000
12	Telecommunications / Information Technology	1	LS	$ 2,500	$ 2,500
13	Vehicle Insurance	1	LS	$ 2,000	$ 2,000
14	General / Environmental Insurance	1	LS	$ 1,000	$ 1,000
15	Engineering / Consulting Services	1	LS	$ 5,000	$ 5,000
16	Environmental Monitoring Services	1	LS	$ 5,000	$ 5,000
17	Legal Services	1	LS	$ 5,000	$ 5,000
18	Mowing & Other Contracting Services	1	LS	$ 2,500	$ 2,500
19	Dues & Association Fees	1	LS	$ 1,500	$ 1,500
20	Permit Fees	1	LS	$ 1,500	$ 1,500
21	Office Supplies	1	LS	$ 2,000	$ 2,000
22	Janitorial	1	LS	$ 1,000	$ 1,000
23	Operations & Maintenance Supplies	1	LS	$ 1,500	$ 1,500
24	Uniforms	1	LS	$ 1,000	$ 1,000
25	Miscellaneous Maintenance / Repair	1	LS	$ 5,000	$ 5,000
					$ -
	SUBTOTAL				$ 454,000
	CONTINGENCY (20%)				$ 90,800
	TOTAL ESTIMATED ANNUAL OPERATING COST				**$ 544,800**
	WASTE ACCEPTANCE RATE	140	tpd		
	ANNUAL OPERATING COST PER TON				$ 18.71

Similar to operating a co-located MRF, compared to the estimated annual cost to operate a Town-only transfer station, as presented in Section 7, the incremental cost to operate a compost facility in addition to traditional transfer station operations is estimated to be approximately $202,800. This incremental cost is attributed to one (1) additional staff position to process these vegetative materials in addition to the staff dedicated to the transfer station operation as well as increase in the annual equipment debt service and maintenance for these operations.

9.2 CONCLUSION AND RECOMMENDATIONS

As noted above, siting and developing a new stand-alone MRF is not considered to be a productive or economically viable endeavor due to prohibitive costs arising from insufficient material quantities (yielding infeasible economies of scale). Competition from ongoing successful regional recycling operations (i.e., Orange County), and the policy challenges that would arise from the need to divert the materials currently collected by Orange County under the County's existing recycling programs to such a facility serve as further disincentives. Developing a new transfer station which is designed and constructed to include capabilities for sorting incoming wastes and handling recyclable materials or vegetative and organic wastes for composting or emerging waste conversion technologies (e.g., anaerobic digestion) is suggested as the preferred approach.

Consistent with Town values and ongoing sustainability efforts, should the Town decide to pursue a new Town transfer station as a long-term waste management option, the incremental cost to expand this design and develop a co-located MRF or co-located composting facility would provide several tangible and intangible benefits. These include:

- An ability to capture and divert additional recoverable materials from the waste stream, before its ultimate bulk transfer for landfill disposal, thus promoting continued improvement towards the region's 61% waste diversion goal.

- Accordingly, such additional diversion reduces waste disposal costs (i.e., tip fees) and improves the efficiency of a Town transfer station option.

- Designing MRF capability into a transfer station preserves ability for the Town to capitalize on one or more emerging waste conversion technologies as they develop in the future.

- Developing potential new waste processing capabilities within the Town presents possible new opportunities for regional collaboration and additional program revenue.

- Furthermore, developing a transfer station with MRF and other material processing capabilities promotes the Town's values of environmental stewardship/sustainability, and responsibility.

SCS recommends that the Town not engage in development of a stand-alone MRF at this time for the following reasons: 1) Siting and developing a new stand-alone MRF is not considered to be a productive or an economically viable operation due to prohibitive costs arising from insufficient material quantities (yielding infeasible economies of scale); and, 2) it would have a negative impact on the current regional cooperative recycling strategy with Orange County. However, in the event the Town pursues development of its own transfer station, SCS recommends the Town consider potential adaptation of the facility to include additional equipment and capabilities to enable recovery and processing of yard waste, recyclables and possibly organic wastes. The concept of a co-located MRF and/or vegetative waste composting facility in conjunction with a transfer station could be further refined in conjunction with future siting and design efforts, as appropriate.

10.0 DISPOSAL OPTION – DIRECT HAUL TO OUT-OF-COUNTY LANDFILL

Similar to the disposal option scenario of direct hauling Town-generated MSW to an existing transfer station as discussed in Section 6 above, SCS evaluated the option of direct hauling Town-generated MSW to an existing landfill facility for disposal using the Town-owned collection vehicles. Like the transfer station option, this scenario was deemed to be one of the more reasonable options for short-term implementation if determined to be economically viable. SCS's methodology, assumptions, and analysis are presented as follows.

SCS conducted a survey of permitted public and private landfill facilities in the vicinity of the Town and identified appropriate target facilities within a reasonable distance from the Town. With this evaluation, SCS considered the following variables and inputs to determine the lowest cost disposal option:

- Type of facility (i.e., MSW, CDD, yard waste, etc.);
- Hauling distance;
- Disposal tipping fees;
- Average daily throughput of the facility;
- Collection and transportation fleet fuel and maintenance costs;
- Fleet modifications or upgrades; and,
- Labor and collections routing modifications.

10.1 IDENTIFIED TARGET LANDFILL FACILITIES

SCS reviewed several published resources to develop a list of viable target landfills for this direct haul evaluation including the "Directory of Non-hazardous Waste Sites-2011" compiled by the Waste Business Journal and cross-referenced to the listing of solid waste facilities currently permitted by NCDENR. The Waste Business Journal Directory provided an electronically sortable list of facilities for North Carolina and surrounding states which included pertinent information such as:

- Facility type (i.e., landfill, transfer station, MRF, etc.);
- Facility address;
- Owner/Operator description (i.e., public or private);
- Contact information;
- Facility permit number;
- Daily average throughput (tons per day);
- Permitted and remaining capacities; and,
- Tipping fees.

Using these reference sources, a compilation of existing permitted landfills in North Carolina and Virginia was developed along with the estimated driving distance to each facility from a predetermined location presumed to be the geographic center of the Town, which coincides with

the intersection of East Franklin and Columbia Streets. Within a radius of approximately 160 miles, SCS identified 23 MSW landfill facilities for disposal consideration.

Using the current Town MSW collection and disposal quantities summarized in Section 2 for both residential and commercial operations, and assuming an ongoing collection schedule of 2 days per week, the Town's contribution of additional throughput is approximately 150 tons per day that would be required for a landfill to manage the Town's MSW. As expected, based on SCS knowledge of typical landfill design capacities, all landfill facilities identified exhibited capable capacity. SCS identified a total of 4 landfills within a 50 mile radius of the Town, another 9 landfills within a 100 mile radius, and 10 additional landfill facilities greater than a 100 mile radius. Of these 23 landfills, 9 are privately-owned facilities; however, 7 of these 9 private landfills are located more than 100 miles from the Town. These individual facilities are depicted below in Exhibit 10-1 and tabulated in Exhibit 10-2.

Exhibit 10-1. Target Landfill Facilities

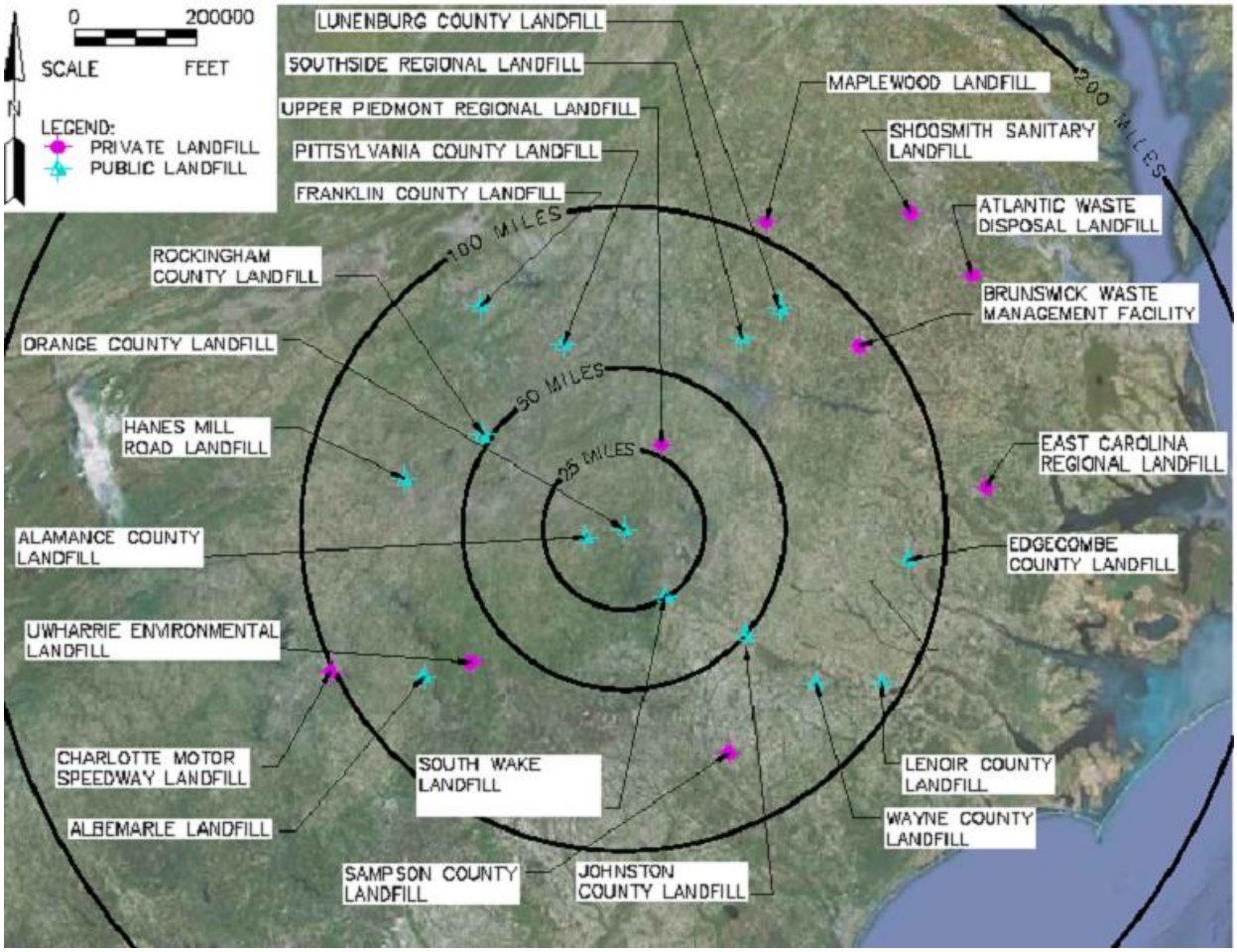


Exhibit 10-2. Summary of Target Solid Waste Landfill Facilities

Facility Name	Type of Facility	City	State	Average Daily Throughput (Tons/Day)	Tipping Fees (Per Ton of MSW)	Distance from Chapel Hill, NC (Miles)	Comments
Qualified Facilities							
Orange County Landfill	Public	Chapel Hill	NC	177	57.00	5	
Austin Quarter SW Management Facility / Alamance County	Public	Grahm	NC	265	38.00	18	Exclusive, County waste only - Not Open to Public
South Wake Landfill	Public	Apex	NC	306	30.00	40	Exclusive, County waste only - Not Open to Public
Republic Services - Upper Piedmont Environmental Landfill	Private	Rougemont	NC	1493	32.67	46	
Johnston County Landfill	Public	Smithfield	NC	363	33.00	60	Exclusive, County waste only - Not Open to Public
Pittsylvania County Landfill	Public	Dry Fork	VA	163	60.00	72	Exclusive, County waste only - Not Open to Public
Rockingham County Landfill	Public	Madison	NC	287	36.00	75	Open to Public
Southside Regional Landfill	Public	Chase City	VA	262	35.50	78	Open to Public
Uwharrie - Montgomery Landfill	Public	Mount Gelad	NC		31.00	85	
Hanes Mill Road Landfill	Public	Winston-Salem	NC	803	34.00	85	
Wayne County Landfill	Public	Dudley	NC	446	30.00	93	Exclusive, County waste only - Not Open to Public
Scotland County Landfill	Public	Laurinburg	NC	179		95	No posted tip fee. Facilities within similar distance.
Albemarle Landfill	Public	Albemarle	NC	146	28.00	96	Open to Public
Waste Industries - Sampson Co. Landfill	Private	Roseboro	NC	3442	29.79	100	
Lenoir County Landfill	Public	La Grange	NC	162	60.00	101	Exclusive, County waste only - Not Open to Public
Edgecombe County Landfill	Public	Tarboro	NC	269.13	46.50	103	Exclusive, County waste only - Not Open to Public
Franklin County Landfill	Public	Rocky Mount	VA	112	32.00	105	Open to Public
Republic Services - Brunswick Waste Management Facility	Private	Lawrencevill	VA	387	36.00	107	
Lunenburg County Landfill	Public	Luenenburg	VA	25	29.00	109	Low Throuput per Day
Chambers Development Landfill	Private	Polkton	NC			115	No posted tip fee. Facilities within similar distance.
Republic Services - BFI Charlotte Motor Speedway Landfill	Private	Concord	NC	3846	44.00	130	
Waste Management - Maplewood Landfill	Private	Jetesrville	VA	702	45.00	133	
Republic Services - East Carolina Regional Landfill	Private	Aulander	NC	1640	60.46	140	
Shoosmith Sanitary Landfill	Private	Chester	VA	1634	40.00	155	
Atlantic Waste Disposal Landfill	Private	Waverly	VA	5020	47.00	160	

10.2 SCENARIO MODELING ANALYSIS

Like the short-term disposal option of direct hauling to a transfer station, the scenario modeling analyses of this short-term disposal option were structured to result in the least impact to the current level of service that Town customers receive and the least disruption to existing Town collections systems, personnel and equipment; while also providing sufficient collection capacity to enable Town vehicles to make a single trip to the target landfill per day. Furthermore, the various scenarios within this analysis include program modifications that are anticipated to reflect changes in equipment, personnel, and routing over time (e.g., scheduled fleet replacement, inflation, and population growth, etc.).

For this MSW disposal option of direct hauling to an existing transfer station, the analysis incorporates the allocated equipment and labor waste collections resources provided in the Town‘s FY 2012-13 budget. The routing configurations, labor, and equipment are allocated such that each residential collections crew can collect along its dedicated route, transport, and generally dispose one (1) load at the Orange County Landfill within the workday. This analysis recognized that a few Town vehicles make a second trip along a limited number of routes. The commercial collections crew usually accomplishes disposal of two loads at the Landfill per day. The evaluation of the direct haul scenarios is structured to enable the residential and commercial crews to avoid having to complete multiple trips to the target landfills.

Other relevant assumptions critical to this direct haul to a landfill analysis are identical to those made with SCS’s evaluation of direct hauling MSW to a target transfer station facility. Detailed discussions of these assumptions are presented in Section 6 and include:

- Collections Fleet Modifications and Capital Expenditures
  - Compliance with NCDOT Overweight Regulations
  - Systematic Replacement of Single-axle vehicles with Tandem-axle vehicles
  - Assumed the Town’s budgeted annual capital expense for previous equipment replacement as provided = $311,000 per year
- Existing Fleet Summary and Projected Replacement Schedule
  - Seven (7) Residential routes
  - Two (2) Commercial routes
  - Seven (7) year vehicle replacement schedule initiating with existing vehicle age
- Fleet Modifications
  - Scheduled replacement of existing Residential rear loader vehicles with tandem-axle 18 to 20 cubic yard vehicles according to the 7-year schedule. Larger capacity vehicles (25 cubic yard) can be utilized as well. Next scheduled replacement FY 2012-13.
  - Annual amortization cost according to a 7-year amortization schedule and 4% financing rate
  - No modifications to Commercial collections fleet
- Routing Modifications
  - Evaluated adding one (1) additional Residential route, resulting in a total of seven (7) routes. Equipped with an existing, stand-by collection vehicle.
  - One (1) additional 3-man crew for this seventh route

  - Separate analysis evaluated a phased implementation of automated collections along one (1) of the existing routes in both the six (6) route and seven (7) route options
- Fleet Fuel and Maintenance Costs
  - Determined from historical Town records
  - Incremental costs resulting from traveling further distance to target landfills on a facility-by-facility basis
  - Includes incremental costs for replacement vehicle(s) on a year-over-year basis
- Impacts to Task-Based Collections System Structure
  - Calculation of additional off-route time to transport MSW to target landfill facilities on a facility-by-facility basis
  - Comparison to available flex time currently awarded to collections staff under the seven (7) route 2-day collections option
- Other Assumptions
  - Each modeling scenario includes the forfeiture of current transportation and disposal costs associated with hauling to the Orange County Landfill
  - 3% cost of inflation
  - Baseline fiscal year of FY 2012-13 for comparison purposes

10.3 SCENARIO MODELING RESULTS

The scenario modeling analysis provides a comparison of the Town's current annual budget for FY 2012-13 to projected budget expenditures for FY 2013-14. The evaluation of the lifecycle costs to direct haul MSW to identified landfills within approximately 160 miles of the Town concludes that these landfill options do not present greater economic benefit compared to the analysis of direct hauling to existing transfer stations. Direct hauling of MSW to either the City of Durham transfer station (Permit No. 3212-T) or the Waste Industries transfer station (Permit No. 3214-T), also located in Durham, represents the most economically attractive short-term disposal option.

One (1) public landfill, the Alamance County - Austin Quarter Landfill was identified within the same general traveling distance from the Town as the City of Durham transfer stations (i.e., 17.5 miles); however, this landfill facility is reserved for disposal of wastes generated exclusively within Alamance County. The analysis indicates that the estimated costs to transport and dispose Town MSW at this facility are lower than the direct haul to transfer station estimated costs. But SCS and the Town must recognize the challenges to gaining acceptance of the Town's waste for disposal at this exclusive municipal landfill, unless more regional collaboration can be generated. The analysis concludes that, while exhibiting lower tip fees, the distances to the remaining qualified landfill facilities cause the additional transportation costs to offset the gains in disposal cost savings.

10.3.1 Results – Current Seven Routes 2 Days Per Week

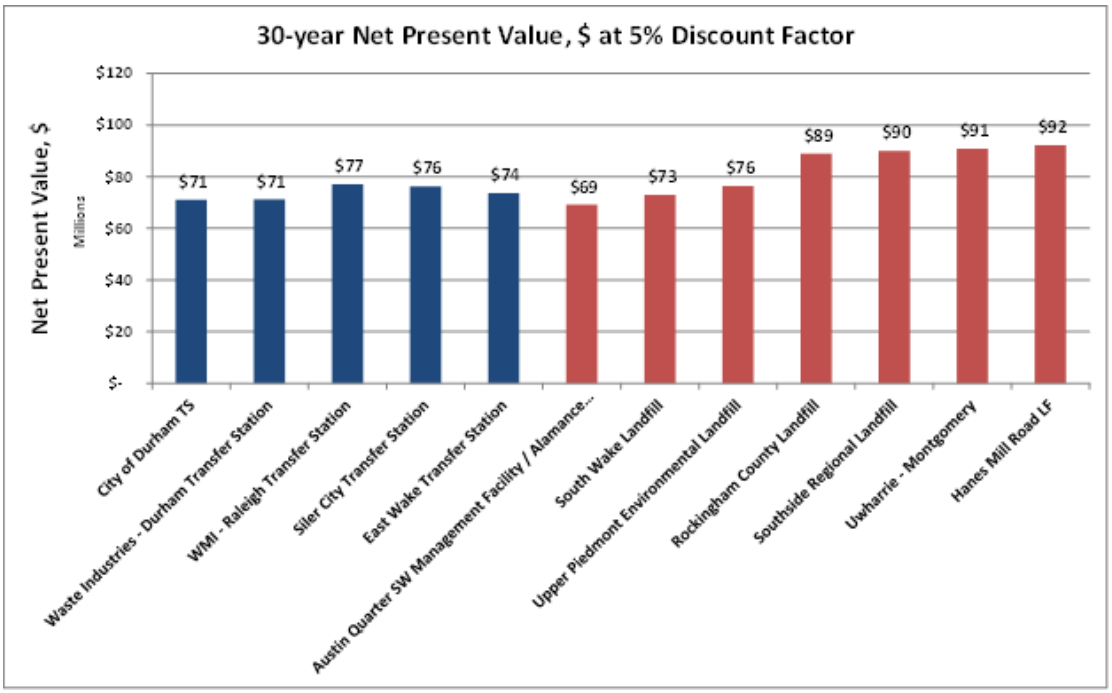
In this analysis, projected capital expenditures include the replacement of one (1) rear loader compactor truck with a new tandem-axle 18 to 20 cubic yard or larger capacity compactor truck in accordance with the Town's current budgeted capital expenditure assumptions. As noted

previously, the four existing single-axle vehicles should be replaced as well. However, additional salary expenses are, but will be comparable to staffing expenditures in FY 2011-12. In FY 2012-13, the staffing budget was reduced due to open positions being intentionally held vacant to allow for organizational flexibility pending the results of this Study. To include three additional full-time employees for the residential collections crew along with the replacement of one rear loader compactor truck, the analysis projects an additional $783,300 dollars would be incurred of the Town budget in FY 2012-13 if MSW is direct hauled to the Upper Piedmont Environmental Landfill.

The Pro Forma modeling concludes that the transfer station disposal option remains the preferred short-term disposal recommendation. As identified above, one (1) public landfill facility exists within similar distance from the Town as the Durham transfer stations; however, the facility is reserved for the exclusive use of Alamance County. A second public landfill facility was identified within reasonable proximity, the South Wake Landfill; but similarly this landfill is reserved for disposal of solid waste generated exclusively within Wake County. Furthermore the Pro Forma modeling analysis concluded that the potential gains in disposal tip fee costs are offset by the additional mileage (i.e., 28 miles versus 18 miles) incurred traveling to this neighboring facility. SCS recognizes that the Town may petition Alamance County or Wake County to accept its MSW; however, SCS understands such action would require county government to modify their ordinances and facility permit from NCDENR. Therefore, these options do not appear politically viable as short-term disposal options even though they are economically competitive with the transfer station options.

The comparative cost analysis of the direct hauling MSW to target transfer stations versus direct hauling MSW to these identified landfills assuming seven (7) routes and 2-day per week collections is summarized in Exhibit 10-3. Other routing scenarios may be viable and should be evaluated further as part of a routing and technology analysis.

Exhibit 10-3. Net Present Value Comparison: Transfer Station to Landfill (7 Routes 2 Days Per Week)



10.3.2 Net Present Value Evaluation

Like the previous disposal option analyses, the financial modeling conducted under this evaluation provides the capability to project and calculate the Town's total Solid Waste Services Division (SWSD) program cost over a 30-year period while assuming the implementation of the various disposal options evaluated. This analysis assumes a 5% discount factor and includes year-over-year adjustments for inflation, capital expenditure schedule, salary projections, and other Town and scenario-specific program assumptions. The total program costs for each disposal option may then be compared in terms of present term, 2013 value.

When comparing the option of direct hauling to identified target landfills, versus direct hauling to identified target transfer stations, over a 30-year period, the net present value of the options immediately available to the Town, specifically excluding the Alamance and South Wake County landfill facilities, is greater than each of the viable transfer station options. This financial analysis supports the recommendation to direct haul MSW to an existing transfer station.

10.4 OTHER CONSIDERATIONS

10.4.1 Long-Term Tip Fee and Mileage Analysis

With this particular disposal option analysis, SCS has identified the majority of public and private landfill facilities in the region and summarized their respective disposal fees and distances from the Town. With these data and algorithms inherent to the Pro Forma modeling tool, SCS and the Town may easily and efficiently assess the various long-haul disposal options applicable to a number of other disposal option scenarios being evaluated with this Study. Most notably, should the Town consider siting and constructing a Town-operated transfer station or MRF, thus consolidating the Town waste for bulk shipment out-of-county to one of these identified facilities, this analysis is readily implemented to assess the full, life-cycle cost of the various ultimate landfill disposal options.

10.4.2 Disposal Option Sustainability Analysis

Like the alternate short-term disposal option evaluated of direct hauling MSW to a transfer station, several other factors weigh into the longer term evaluation of this disposal option of direct hauling to a landfill. These considerations are not as readily quantified with respect to fiscal impact since they relate to risk management, environmental impacts, and socio-economic issues. However, these factors have the potential to create financial implications and indeed resonate with the Town's stated values and goals and must be considered along with the financial evaluation. Several of the more decisive factors include:

- Safety of the Town solid waste collections staff hauling waste even longer distances and over more heavily traveled roadways compared to the distance to Durham;
- Increased risk to other motorists due to hauling waste longer distances and over more heavily traveled roadways;
- A desire to manage Town-generated waste internally and not having to rely on a neighboring disposal system, and a loss of control over ultimate disposal and costs; and,
- A potential loss of focus on Town waste reduction goals.

10.5 CONCLUSIONS AND RECOMMENDATIONS

The results of SCS's analysis of this disposal option concluded that direct haul to available existing landfill facilities did not provide any economic advantages over direct hauling to identified existing transfer station facilities. Therefore, in consideration of short-term disposal option analysis, direct haul to a transfer station facility remains the recommended solution for the Town.

11.0 DISPOSAL OPTION – SITE/ CONSTRUCT A NEW LANDFILL

11.1 EVALUATE DEVELOPMENT OF A NEW TOWN-ONLY OR REGIONAL LANDFILL

SCS evaluated the feasibility of the Town developing a new municipal solid waste landfill. The analysis provides the following:

- Summary of the challenges and obstacles to siting a new landfill in the Town (e.g., economics, social justice, siting, permitting criteria, etc.).
- Summary of the benefits of siting and operating a Town-owned landfill in the region, either on its own or in conjunction with other regional municipal partners.
- An order of magnitude cost estimate for the permitting, capital construction, operation, maintenance, closure, and post-closure care for a Town-only or regional landfill for a 30-year period in order to compare it with other solid waste management options.

The landfill evaluation presented below is general in nature and compliments previously identified solid waste management options for the Town.

11.1.1 Landfill Siting Challenges

Siting a new landfill would be difficult regardless of whether it was a Town-only or regional landfill. Landfill siting efforts require extensive environmental, socio-economic, and transportation studies, and public and regulatory involvement. The process can take 5 to 10 years to complete. For example, the State's Solid Waste Management Act of 2007 (S1492) significantly changed the state's solid waste laws, and put in place limits on the size of new landfills, provided additional protections for scenic rivers, fisheries, sensitive wetlands, and endangered species, and included provisions for protecting minority communities from the negative impacts of solid waste disposal sites. The law also provided additional setbacks restricting the development of landfills within 2 miles of state parks and 5 miles from national wildlife refuges.

The Town and Orange County have extensive experience with the current County-owned and operated Orange County Landfill, located at 1514 Eubanks Road, Chapel Hill, NC. The MSW landfill unit of the Orange County Landfill is scheduled to be closed at the end of June 2013 before it reaches its ultimate disposal capacity. We understand the decision to close the Orange County Landfill was in part due to local community concerns and social justice issues (Rogers-Eubank Community).

The decision to close the MSW landfill unit before it reaches its ultimate capacity indicates that siting a new landfill within the Town limits would be contentious and difficult, and would require strong political leadership and resolve to be successful. In addition, the availability of

land within the Town's limits that meets the regulatory siting restrictions outlined in the North Carolina Department of Environment and Natural Resources solid waste regulations (15A NCAC 13B) and community criteria that would be developed may be limited. However, additional studies would be needed to confirm this. In addition, as will be demonstrated below, the cost for a Town-only landfill would likely be prohibitive, although a new regional landfill could likely be developed at a tip fee rate similar to what the Town currently pays.

11.1.1.1 Advantages

The following advantages can be associated with developing a new regional landfill within the Town or close to the Town:

- Reduced transportation costs and consumption of fossil fuels.
- Relatively predictable and stable future landfill disposal costs.
- Self-sufficiency.
- Ability to quickly respond to emergencies or other unanticipated conditions.
- A regional landfill would reduce the costs allocated to regional members.
- Landfill gas utilization (limited development potential for a Town-only landfill, but may be of value relative to a regional landfill).

11.1.1.2 Disadvantages

The following disadvantages can be associated with developing a new regional landfill within the Town or close to the Town:

- Long-term commitment required (operational and post-closure care periods).
- Community opposition and potential impacts to communities surrounding the landfill (noise, vectors, odors, and traffic), although mitigation measures can reduce or eliminate these impacts.
- Potential long-term liabilities associated with groundwater, surface water, and air quality.
- Significant capital investment required (see discussion below).
- Developing a new landfill could require 5 to 10 years to complete. As such, it is not available as a short-term alternative to the Town in the near future.

11.1.2 Projected 30-Year Disposal Needs

SCS evaluated the projected MSW disposal requirements for a Town-only and regional landfill over the next 30 years. The projections take into account the projected changes in population

during that period. The projected population changes for the Town between now and 2035 are presented in Exhibit 11-1.

Exhibit 11-1. Population Projections, Town of Chapel Hill

Year	Population Estimates	% Change Per Year*
2000	48,715	
2010	57,233	
2015	65,748	2.98%
2025	77,767	2.39%
2035	80,483	1.62%

Source: See Section 2.1.4.1
*Based on 2010

The disposal rates were projected based on a 1.62% per year increase for both the Town-only and the regional landfill options. A further refinement on the regional population growth trends could be considered, but for the purpose of this evaluation, the same growth rate was used for the Town and Region. The yearly projected MSW disposal quantities for a Town-only and regional landfill are presented in Exhibit 11-2. This exhibit does not include solid waste program changes that could ultimately reduce the quantity of MSW requiring disposal in a landfill; therefore, the estimated disposal rates presented are conservative.

The hypothetical landfill dimensions and disposal capacities presented in Exhibit 11-3 are based on a number of assumptions regarding the allowable maximum slopes (33%), benching, maximum fill height, top deck configuration, and setbacks to property line from the landfill footprint. A setback of 1,000 feet from the landfill waste footprint was assumed to provide for visual buffers, regulatory setback, ancillary facilities (stormwater, maintenance, leachate storage, fueling, and other solid waste facilities), and borrow areas.

Obviously with larger landfill footprints, higher fill heights could be achieved than shown in the exhibit. Constructing a landfill to higher fill heights would provide for more disposal capacity than shown in the exhibit. However, for the relatively small landfill footprints for both the Town-only and regional landfill scenarios, a maximum elevation of 100 feet above grade was selected. The net volume shown in the exhibit represents the total calculated airspace volume minus the estimated volume for a 3-foot-thick final cover system. For the purposes of this evaluation, Exhibit 11-4 summarizes the landfill footprint and total land areas that would be required for a Town-only and regional landfill to provide disposal capacity for the next 30 years.

Exhibit 11-2. 30-Year Disposal Quantity Projections

Projection Year	Fiscal Year	Town-Only Landfill (tons)	Regional Landfill (tons)
1	2013	15,300	65,000
2	2014	15,540	66,100
3	2015	15,810	67,200
4	2016	16,060	68,300
5	2017	16,310	69,400
6	2018	16,580	70,500
7	2019	16,860	71,600
8	2020	17,130	72,800
9	2021	17,400	74,000
10	2022	17,690	75,200
11	2023	17,980	76,400
12	2024	18,260	77,600
13	2025	18,580	78,900
14	2026	18,870	80,200
15	2027	19,170	81,500
16	2028	19,490	82,800
17	2029	19,800	84,100
18	2030	20,120	85,500
19	2031	20,450	86,900
20	2032	20,780	88,300
21	2033	21,110	89,700
22	2034	21,470	91,200
23	2035	21,820	92,700
24	2036	22,180	94,200
25	2037	22,530	95,700
26	2038	22,890	97,300
27	2039	23,260	98,900
28	2040	23,630	100,500
29	2041	24,040	102,100
30	2042	24,410	103,800
Totals		585,520	2,488,400

Exhibit 11-3. Disposal Capacity and Total Property Area as a Function of Landfill Footprint Area

Landfill Footprint (Acres)	Total Property Area (Acres)	Design Height h1	Net Volume (cy)	Density (tons/cy)	Capacity (tons)
10	63	77	456,000	0.75	342,000
20	86	100	1,256,000	0.75	942,000
30	105	100	2,095,000	0.75	1,571,000
40	124	100	3,019,000	0.75	2,264,000
50	141	100	4,015,000	0.75	3,011,000
100	219	100	9,541,000	0.75	7,156,000
200	359	100	22,564,000	0.75	16,923,000
300	489	100	37,512,000	0.75	28,134,000
400	615	100	53,408,000	0.75	40,056,000
500	737	100	70,987,000	0.75	53,240,000

Town-only Landfill
Regional Landfill

Exhibit 11-4. Summary of Landfill Sizing Requirements

Landfill Scenario	Landfill Footprint Area (Acres)	Total Landfill Property Area (Acres)
Town-Only Facility	15 – 20	75-86
Regional Facility	45 – 50	132 – 141

11.1.3 Estimated Landfill Development Costs

SCS prepared conceptual budget cost estimates for the construction and operation for both landfill scenarios. The construction cost estimates include costs for siting, permitting, design, land acquisition, cell development, stormwater management, leachate management, landfill gas management, scalehouse and scales, maintenance facilities, access roads, and ancillary support facilities. The estimates are based on SCS's experience working with municipal and private clients throughout the region, and were prepared to provide an order-of-magnitude estimate of the critical aspects of landfill construction and operation. The land acquisition cost of $20,000 per acre was assumed based on a cursory review of current rural property listings in the Town.[18]

18http://www.landandfarm.com/search/NC/Chapel-Hill-land-for-sale/#/search/NC/Chapel-Hill-land-for-sale/?CurrentPage=2

If the Town were to develop a landfill under either scenario, more detailed estimates would need to be prepared based on actual site information. Exhibit 11-5 and Exhibit 11-6 present a summary of the estimated capital construction costs to develop a new Town-only or regional landfill, respectively.

Exhibit 11-5. Estimated Cost to Develop a Town-Only Landfill

Item	Unit	Quantity	Unit Price	Subtotal	Total
Land Acquisition	ac	86	$20,000	1,720,000	$1,720,000
Site Access	ls				$474,000
Stormwater					$117,000
Cell Development	ac	20	$250,000		$5,000,000
Support Facilities	ls				$714,000
LFG System	ls				$588,000
				Total	**8,613,000**
				Contingency (20%)	$1,723,000
				Subtotal	**$10,336,000**
Engineering, Permitting, CQA	%	15%	$6,893,000		$1,033,950.00
Total					**$11,369,950**
Amortized Cost, 30 years, 4%, $/year					**$658,000**

Exhibit 11-6. Estimated Cost to Develop a Regional Landfill

Item	Unit	Quantity	Unit Price	Subtotal	Total
Land Acquisition	ac	141	$20,000	2,820,000	$2,820,000
Site Access	ls				$717,000
Stormwater					$181,000
Cell Development	ac	50	$250,000		$12,500,000
Support Facilities	ls				$990,000
LFG System	ls				$702,000
				Total	**17,910,000**
				Contingency (20%)	$3,582,000
				Subtotal	**$21,492,000**
Engineering, Permitting, CQA	%	15%	$15,090,000		$2,263,500
Total					**$23,755,500**
Amortized Cost, 30 years, 4%, $/year					**$1,374,000**

For conceptual cost estimating purposes, the capital costs for each scenario are amortized over the 30-year projection period at 4% interest to estimate the yearly allocated capital expenditure costs.

11.1.4 Estimated Landfill Operations Costs

Exhibit 11-7 and Exhibit 11-8 present the estimated annual operation costs for the Town-only and regional landfill scenarios, respectively. The annual operational costs include personnel, equipment, and materials needed to operate a landfill. The annual operational costs also include an annual permit renewal fee ($3,500) and the excise tax owed on a per ton basis using the current tax rate of $2 per ton.

Exhibit 11-7. Estimated Annual O&M Cost for Town Only Landfill Scenario

No.	Item Description	Quantity	Unit	Engineer's Unit Price Est.	Engineer's Total Estimate
1	Personnel Salaries	5	LS	$ 50,000	$ 250,000
2	Personnel Benefits	5	LS	$ 15,000	$ 75,000
3	Landfill Equipment Debt Service	4	LS	$ 40,000	$ 160,000
4	Landfill Equipment Maintenance / Repair	4	LS	$ 7,500	$ 30,000
5	Equipment - Lease/Rental	1	LS	$ 10,000	$ 10,000
6	Vehicle Fuel	20,000	Gal	$ 3.50	$ 70,000
7	Vehicle Supplies	1	LS	$ 5,000	$ 5,000
8	Leachate Treatment	2,000,000	Gal	$ 0.03	$ 60,000
9	Landfill Gas Operations	1	LS	$ 15,000	$ 15,000
10	Erosion Control / Seeding	1	LS	$ 20,000	$ 20,000
11	Stone	1	LS	$ 10,000	$ 10,000
12	Soil Cover and ADC	1	LS	$ 25,000	$ 25,000
13	Electricity & Heating	1	LS	$ 12,500	$ 12,500
14	Water & Sewer	1	LS	$ 2,500	$ 2,500
15	Telecommunications / Information Technology	1	LS	$ 5,000	$ 5,000
16	Vehicle Insurance	1	LS	$ 2,500	$ 2,500
17	General / Environmental Insurance	1	LS	$ 2,500	$ 2,500
18	Engineering / Consulting Services	1	LS	$ 50,000	$ 50,000
19	Environmental Monitoring Services	1	LS	$ 50,000	$ 50,000
20	Legal Services	1	LS	$ 10,000	$ 10,000
21	Mowing & Other Contracting Services	1	LS	$ 10,000	$ 10,000
22	Dues & Association Fees	1	LS	$ 2,500	$ 2,500
23	Permit Fees and Excise Tax	1	LS	$ 35,000	$ 35,000
24	Office Supplies	1	LS	$ 1,000	$ 1,000
25	Janitorial	1	LS	$ 1,000	$ 1,000
26	Operations & Maintenance Supplies	1	LS	$ 2,500	$ 2,500
27	Uniforms	1	LS	$ 1,000	$ 1,000
28	Miscellaneous Maintenance / Repair	1	LS	$ 10,000	$ 10,000
					$ -
	SUBTOTAL				$ 928,000
	CONTINGENCY (20%)				$ 185,600
	TOTAL ESTIMATED ANNUAL OPERATING COST				**$ 1,113,600**
	WASTE ACCEPTANCE RATE (Average Annual)	15,540	tpy		
	ANNUAL OPERATING COST PER TON				$ 71.66

Exhibit 11-8. Estimated Annual O&M Cost for Regional Landfill Scenario

No.	Item Description	Quantity	Unit	Engineer's Unit Price Est.	Engineer's Total Estimate
1	Personnel Salaries	8	LS	$ 50,000	$ 400,000
2	Personnel Benefits	8	LS	$ 15,000	$ 120,000
3	Landfill Equipment Debt Service	7	LS	$ 40,000	$ 280,000
4	Landfill Equipment Maintenance/ Repair	7	LS	$ 7,500	$ 52,500
5	Equipment - Lease/ Rental	1	LS	$ 15,000	$ 15,000
6	Vehicle Fuel	40,000	Gal	$ 3.50	$ 140,000
7	Vehicle Supplies	1	LS	$ 10,000	$ 10,000
8	Leachate Treatment	3,000,000	Gal	$ 0.03	$ 90,000
9	Landfill Gas Operations	1	LS	$ 20,000	$ 20,000
10	Erosion Control/ Seeding	1	LS	$ 30,000	$ 30,000
11	Stone	1	LS	$ 15,000	$ 15,000
12	Soil Cover and ADC	1	LS	$ 50,000	$ 50,000
13	Electricity & Heating	1	LS	$ 15,000	$ 15,000
14	Water & Sewer	1	LS	$ 2,500	$ 2,500
15	Telecommunications/ Information Technology	1	LS	$ 5,000	$ 5,000
16	Vehicle Insurance	1	LS	$ 5,000	$ 5,000
17	General/ Environmental Insurance	1	LS	$ 5,000	$ 5,000
18	Engineering/ Consulting Services	1	LS	$ 75,000	$ 75,000
19	Environmental Monitoring Services	1	LS	$ 75,000	$ 75,000
20	Legal Services	1	LS	$ 10,000	$ 10,000
21	Mowing & Other Contracting Services	1	LS	$ 20,000	$ 20,000
22	Dues & Association Fees	1	LS	$ 3,000	$ 3,000
23	Permit Fees & Excise Tax	1	LS	$ 135,000	$ 135,000
24	Office Supplies	1	LS	$ 2,000	$ 2,000
25	Janitorial	1	LS	$ 2,000	$ 2,000
26	Operations & Maintenance Supplies	1	LS	$ 5,000	$ 5,000
27	Uniforms	1	LS	$ 2,000	$ 2,000
28	Miscellaneous Maintenance/ Repair	1	LS	$ 15,000	$ 15,000
					$ -
	SUBTOTAL				$ 1,599,000
	CONTINGENCY (20%)				$ 319,800
	TOTAL ESTIMATED ANNUAL OPERATING COST				**$ 1,918,800**
	WASTE ACCEPTANCE RATE (Average Annual)	65,000	tpy		
	ANNUAL OPERATING COST PER TON				$ 29.52

11.1.5 Closure and Post-Closure Care Cost Estimates

Closure and post-closure care costs would need to be accrued on an annual basis to fund the closure and post-closure care requirements. Closure costs include the costs to close the entire landfill upon achievement of final grades. Typically, landfills are closed on a phased basis, but for the purpose of this analysis, SCS estimated the total closure costs and amortized these costs over the 30-year projected life of the landfill. The closure costs were developed based on estimated costs to construct a composite final cover system (low permeability soil and

geomembrane final cover), including final cover vegetation. The analysis assumed an average closure cost of approximately $126,000/acre for both scenarios. The estimated closure costs for a 20-acre, Town-only landfill would be approximately $2.5 million, and for the 50-acre regional landfill of $6.3 million. Amortized over 30 years at 4%, these capital costs would represent an annual cost of $146,000/year and $364,000, respectively.

The annual post-closure care costs for the two landfill scenarios were estimated. Post-closure would be required for a minimum of 30 years. SCS estimated the 30-year post-closure care costs to the two scenarios to be $3.6 million and $5.2 million, respectively, with an estimated annual accrual of approximately $120,000 and $172,000, respectively. The post-closure care activities include maintaining the final cover system and other environmental control systems (landfill gas, leachate, and stormwater), and environmental monitoring.

11.1.6 Summary of Landfill Development, Operations, Closure, and Post-Closure Costs

Exhibit 11-9 presents a summary of the estimated costs to develop, operate, close, and provide for post-closure care for the Town-only and regional landfill scenarios. This exhibit demonstrates the importance of economies of scale in developing and operating a landfill. As depicted in the exhibit, operating a Town-only landfill would be cost prohibitive on a dollar per ton basis, while the total estimated cost for the regional landfill scenario is similar on a dollar per ton basis to what the Town currently is paying for disposal at the Orange County Landfill.

Exhibit 11-9. Summary of Estimated Landfill Costs

	Town-Only Landfill			Regional Landfill		
Cost Item	Estimate	Annual Cost	$/ton	Estimate	Annual Cost	$/ton
Total Capital Construction Cost, $	$11,369,950	$658,000	$42.34	$23,755,500	$1,374,000	$21.14
Annual Operations Cost, $/year	$1,113,600	$1,114,000	$71.69	$1,918,800	$1,919,000	$29.52
Total Closure Cost, $	$2,520,000	$146,000	$9.40	$6,300,000	$364,000	$5.60
Annual Post Closure Cost, $/yr	$119,700	$119,700	$7.70	$171,600	$171,600	$2.64
Annual Costs, $		$2,037,700	$131.13		$3,828,600	$58.90
Tonnage (2013)	15,540			65,000		
Break Even Tip Fee, $/ton			$131.13			$58.90

11.1.7 Conclusion and Recommendations

As noted above, siting and developing a new Town-only landfill would be difficult for a number of reasons and cost prohibitive due to economies of scale. Developing a new regional landfill provides for better economies of scale, but would face the same difficulties regardless of where it is located in the region. SCS does not recommend that the Town pursue developing its own landfill, but continue to participate in potential future regional cooperative efforts in this regard.

12.0 ALTERNATIVE TECHNOLOGIES – TOWN OF CHAPEL HILL BENCHMARK

The objective of this task was to review the Town and regional solid waste systems and known waste-to-energy (WTE) and waste conversion (WC) technologies to establish a long-term strategy and benchmark system requirements necessary to engage identified feasible technologies. This section of the report identifies key system and technology metrics by which the Town may best position itself to take full advantage of WTE and WC technologies as they may emerge.

During the course of our study, SCS relied on recent information and data collected by Orange County, North Carolina in its solid waste master plan[19], an alternative energy analysis conducted by the University of North Carolina[20], and a recent summary report of waste conversion technologies by the Applied Research Foundation of the Solid Waste Association of North America[21]. In addition, SCS has been monitoring the progress of WTE and WC technologies over the past few years through a series of presentations, trade journal articles, and books[22]. Thus, much of the initial discussion in this section is briefly focused on background, history, and the current status of these technologies. This is then followed by a benchmarking of the Town against the current status of these technologies and recent developments.

12.1 REASONS TO SELECT A WTE OR WC TECHNOLOGY

One of the first questions the Town must answer is what technology will be chosen to convert its solid waste into energy. This includes consideration of factors (which will be discussed later) such as: available energy and materials markets; the size of the Town's waste flow; site availability and location; capital and operating costs; ownership and financing considerations; and the level of risk to be assumed by the Town or the facility operator.

In evaluating whether or not one technology better suits its needs than another, the Town may often discover conflicting goals and values within both the community and within the target WTE/WC project. For example:

- A particular technology may produce the greatest amount of energy for the Town's waste, albeit at high projected capital and operating costs.
- Engaging in WTE or WC technology may impact historical success in other recycling or waste diversion practices (i.e., directing organics from a composting operation to a digester technology).

19 GBB, Alternative Waste Processing Technologies Assessment, August, 2008.
20 Affiliated Engineers, Alternative Energy Analysis, July 2010.
21 Applied Research Foundation, Solid Waste Association of North America, Waste Conversion Technologies, December 2011.
22 Marc J. Rogoff and Francois Screve, Waste-to-Energy Technologies and Project Implementation, Elsevier, June 2011; Marc J. Rogoff, Bruce Clark and Amanda Moore, "Solid Waste Déjà vu: Waste-to-Energy Plant Technologies Break New Ground", APWA Reporter, March 2009.

- A refuse-derived fuel (RDF) technology may impact waste generation minimization efforts with the need to generate more waste for fuel.

The selection of a technology, therefore, is not a simple one, but one which can require tradeoffs between one goal with others. Since the risks associated with WTE and WC technology can be substantial, it is critical that the Town recognize and minimize these risks as best it can. The following criteria can be utilized to assess the relative risk of a particular WTE or WC technology:

- **Degree and Scale of Operating Experience**. The technology must be proven. Most existing technologies, other than conventional mass-burn technology, have only been proven in pilot or laboratory operations, or with raw materials other than municipal solid waste. Other technologies have only been commercially operated in small facilities and the scale up to larger sized plants may result in unforeseen problems.

- **Reliability to Dispose of Municipal Solid Waste.** The technology selected must be capable to dispose of solid waste in a reliable manner without frequent mechanical downtimes resulting in diversion of such waste to landfills.

- **Energy and Material Market Compatibility.** The technology must be capable of recovering energy and materials for which markets are available and viable.

- **Environmental Acceptance.** The technology must meet all permitted environmental requirements established by regulatory agencies.

- **Cost to the Town.** The technology must dispose of the Town's solid waste at a price it is willing to pay given alternative means of disposal.

12.2 CLASSIFICATION OF TECHNOLOGIES

For the purpose of this report, SCS has divided the processes for disposal of municipal solid waste into two main categories:

- Conventional WTE Technology
- Alternative WC Technologies

The conventional WTE technologies include mass-burn incineration and smaller, modular units where unprocessed MSW is fired in a boiler or chamber where the heat is recovered in a series of tubes filled with water or in a heat recovery boiler where the heat is recovered in the form of steam or electricity. Alternatively, shredded MSW with some form of metals recovery can be fired in a chamber either in a dedicated boiler made of water tubes or on a fluidized bed of sand with the energy recovery in the form of steam or converted to electricity.

Alternative conversion technologies can be defined as:

- Alternatives to landfills and standard combustion-based WTE plants
- Potential to produce by-products and chemicals that could be useful

- Compatible with municipal recycling activities
- Potential for less environmental impact

12.3 CONVENTIONAL WTE TECHNOLOGY

12.3.1 Basic Combustion System

The combustion of solid waste is accomplished in a furnace equipped with grates. A solid waste combustion system with energy recovery includes:

- Some type of structure to house the furnace and its appurtenances;
- A "tipping floor" where the solid waste from collection and transfer vehicles is deposited;
- A storage pit or floor to store the solid waste delivered (solid waste combustion is a 7 days per week, 24 hours per day operation; storage space is provided to enable this continuous operation);
- A charging system (normally overhead cranes) which mixes the various solid wastes received to develop a somewhat uniform material and then lifts it from the storage pit or floor and feeds (charges)the furnace;
- One or more furnace subsystems (sometimes referred to as combustion trains), which receive and burn the solid waste;
- A grate unit to move the solid waste through the furnaces; the most common grate designs are:
  - **Reciprocating Grate.** This grate design resembles stairs with moving grate sections which push the solid waste through the furnace.
  - **Rocking Grate.** This grate design has pivoted or rocking grate sections which produce an upward and/or forward motion to move the solid waste through the furnace.
  - **Roller Grate.** This grate design has a series of rotating steep drums or rollers which agitate and move the solid waste through the furnace.
- Air pollution control subsystems to clean up the combustion gases; and,
- An ash handling subsystem to manage the fly ash and bottom ash produced from the combustion of solid waste.

12.3.1.1 Stages of Combustion

Solid waste normally has a moisture content of 20 to 25% by weight. In order to successfully burn solid waste in a furnace, this moisture must be evaporated. Generally, most solid waste combustion units have three stages of reaction:

- **Drying.** Moisture driven off.
- **Ignition.** Solid waste ignited.
- **Burnout.** Solid waste is gradually moved through the furnace by the grate subsystem where the combustible organic fraction of the solid waste is burned out.

Successful combustion of solid waste is accomplished by controlling the “3 Ts of Combustion"- Time, Temperature and Turbulence.

- **Time.** The period taken for solid waste to pass from the charging hopper until the bottom ash is discharged at the end of the grate subsystem (usually 45 to 60 minutes).
- **Temperature.** Usually exceeds 1,800°F (980°C) within the furnace and is directly proportional to the residence time. If there is insufficient time in the furnace, the combustion reaction cannot proceed to completion and temperature declines.
- **Turbulence.** Provided by the grate subsystem moving the solid waste downward through the furnace to expose it to and mix it with air.

Normally, solid waste combustors reduce the original weight of the solid waste by 75+% and the volume by 85 to 90%.

Combustion is aided by the introduction of air at two locations in the furnace. Air is introduced underneath the grates (underfire air) to increase the agitation and turbulence within the furnace and help cool the grates. Air is also introduced above the burning solid waste (overfire air). Overfire air ensures that there is adequate oxygen available to completely oxidize and burn the entire combustible fraction of the solid waste. Overfire air also aids mixing of the combustion gases thereby ensuring complete oxidation and destruction. Combustion gases (also called flue gases) move from the furnace through the flues and the air pollution control systems and are eventually discharged out the stack into the atmosphere.

12.3.1.2 Waste-to-Energy Solid Waste Combustors

In a WTE solid waste combustor, the energy released from combustion in the form of heat is used to generate steam in a boiler. The common method of capturing this released energy is either through refractory or waterwall furnace systems. The major difference between these two designs is the location of the boiler.

- **Refractory Units.** This design consists of boilers located downstream of the combustion (furnace) chamber. The hot combustion gases pass through the boiler tubes to create steam.

- **Waterwall Units.** This design has the furnace constructed with water tube membrane walls to recover the heat energy directly from the furnace unit. Waterwall designs are more commonly used because their thermal efficiency is higher than refractory units.

Boilers convert the heat released to steam, which can be used to either generate electricity or for industrial steam applications (if a customer is nearby). Turbine-driven generators driven by the steam generate electricity.

12.3.1.3 Products of Combustion

Other than the release of energy in the form of heat, the products of combustion of solid waste are fly ash and bottom ash. Each of these byproducts of combustion, air emissions, and ash, present further environmental permitting, handling, and disposal challenges for the WTE technology.

Fly ash is carried in the combustion gas, which also contains a number of contaminants, including acid gases, and other products of incomplete combustion. The gases are passed through a variety of air pollution control devices for cleanup before being discharged out of the stack into the atmosphere.

Bottom ash is the non-combusted material, which is discharged at the end of the grate subsystem. The bottom ash, as it is discharged from the grates, is still burning and is normally quenched by water. In the United States, the two ash streams, fly ash and bottom ash, are normally combined for management and disposal in a permitted MSW or industrial landfill. The two combined ash streams are commonly referred to as solid waste combustor ash, or just ash. In Europe, these two ash streams are not usually combined and are normally managed separately.

12.3.2 Mass Burning

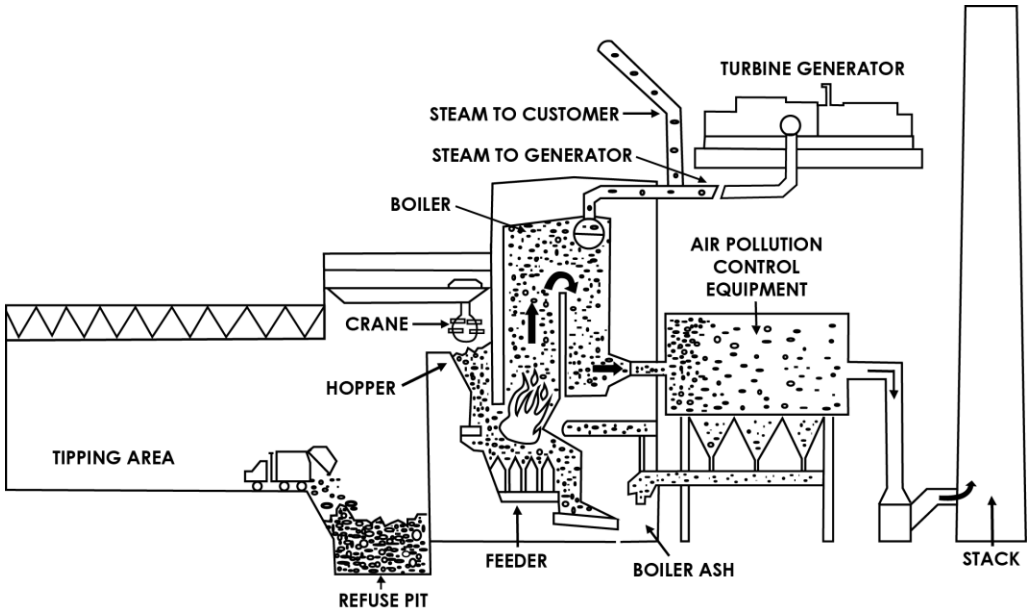
"Mass-burning" refers to the generic name for the type of technology used to incinerate unprocessed solid waste, and thereby releasing its heat energy. The thermal reduction of solid waste through mass-burning has been a common procedure throughout the world. There are decades of experience in constructing and operating some 500 mass burn facilities in the United States and Europe. Such facilities were in operation as early as 1896 in Hamburg, Germany, converting solid waste into electricity.

12.3.2.1 Process Description

An illustration of a typical mass-fired, WTE facility is shown in Exhibit 12-1. Solid waste collection and transfer vehicles proceed into a tipping area where their waste is discharged into a large storage pit, which is usually sized to allow two to three days storage or stockpiling of refuse so that plant operations can continue over weekends and holidays when deliveries will not be accepted. There are some facilities which differ in design by utilizing a tipping floor with a front loader and belt conveyor system as their form of storage and feed system. In almost all facilities, however, the refuse is fed into the furnaces by means of overhead cranes manipulated by a crane operator. Much of the success of the operation depends upon the skill of the crane operator to remove large or unusual objects in the waste stream that would otherwise prove to be a problem if fed into the boiler. The operator is also responsible to observe the nature of the

incoming waste so that materials with different moisture contents are gradually intermixed to try to get uniform moisture content.

Exhibit 12-1. Cross-Section of Typical Mass-Fired Waterwall Facility



The refuse is then discharged into refuse feed hoppers, which meter out the refuse into the combustion chamber, either by gravity feeding or by a hydraulic feeding device. In a majority of systems, the waste is then pushed onto an inclined, step-like, mechanical grate system which continuously rocks, tumbles, and agitates the refuse bed by forcing burning refuse underneath newly fed refuse. Generally, most systems have three zones of activity along the grates: drying, ignition, and burnout. Holes in each grate bar allow underfire air to pass through the grates resulting in cooling and, thus, preventing thermal damage to the grate system. The width of the grate and the number of grate steps is dependent not only upon the manufacturer's specifications, but also on the overall size of the WTE system. There are five basic moving grate designs:

- **Reciprocating Grate.** This grate resembles stairs with alternating fixed or moving grate sections. The pushing action may be in the direction of waste flow or in an upward motion against the waste flow.

- **Rocking Grate.** Pivoted or rocked grate sections produce an upward or forward motion, advancing the waste down the grate.

- **Roller Grate.** A series of rotating stepped drums or rollers agitate the waste and move it down the grate.

- **Circular Grate.** A rotating annular hearth or cone agitates the waste.

- **Rotary Kiln.** As an inclined cylinder rotates, it causes a tumbling action to expose unburned material and advance the waste down the length of the kiln.

Mass burn incineration produces ash resides amounting to 15 to 30% by weight and 5 to 10% by volume of the incoming municipal solid waste. Most facilities can produce an ash product that has less than 5% combustible material and 0.2% putrescible matter.

Recovery of ferrous and non-ferrous materials from the ash residue is possible in mass-burn systems. Many facilities have successfully utilized magnetic separators (with or without trommels) to recover ferrous material from the ash. Some systems have attempted to recover the remaining non-magnetic fraction in the ash, such as aluminum and glass, using various trommels, screens, jigs and fluid separators.

12.3.2.2 Operations Experience

Mass burning incinerators have been used in Europe and Japan for municipal solid waste disposal for nearly 30 years where their acceptance has been rapid and widespread. With over 500 facilities in operation worldwide in sizes ranging from 60 to 3,000 tons per day, mass fired incineration is the most thoroughly demonstrated technology in the WTE field at this time.

This technology was introduced into the United States in 1967 at the U.S. Naval Station in Norfolk, Virginia with the construction of a 360 ton per day waterwall plant to produce process energy for the Naval Shipyard. This plant was designed in America and equipped with American equipment. Later plants, which were constructed, were almost entirely designed using state-of-the-art European mass incineration technology. The National Resource Recovery Association publishes a semi-annual update of WTE activities in the United States. At the time of this comprehensive report, there are 98 WTE facilities using mass incineration technology. Based on our experience with these plants, SCS assumes that an experienced staff of more than 12 people, spread over three shifts per day, is required to continuously operate a mass burn plant of the size potentially applicable to the Town or region.

The introduction of European technology into the United States has not been without difficulties and several of the earlier constructed plants encountered some mechanical problems. These highly reliable and rugged European systems had been designed to burn solid waste that was somewhat different in composition than American wastes. Consequently, systems that had been designed for European conditions required designers to make adjustments in the grate areas and furnace heat release rates of American plants. In addition, the higher chloride corrosion of the superheaters in American plants meant that designers needed to change the metallurgy of these boiler tubes, as well as limiting the upper stream pressures and temperatures to minimize tube corrosion. Scale-up problems also had to be overcome since many of the European unites were designed for the 300 to 500 tons per day range. These problems have been corrected, and most mass-burn systems that have been constructed are still in operation today.

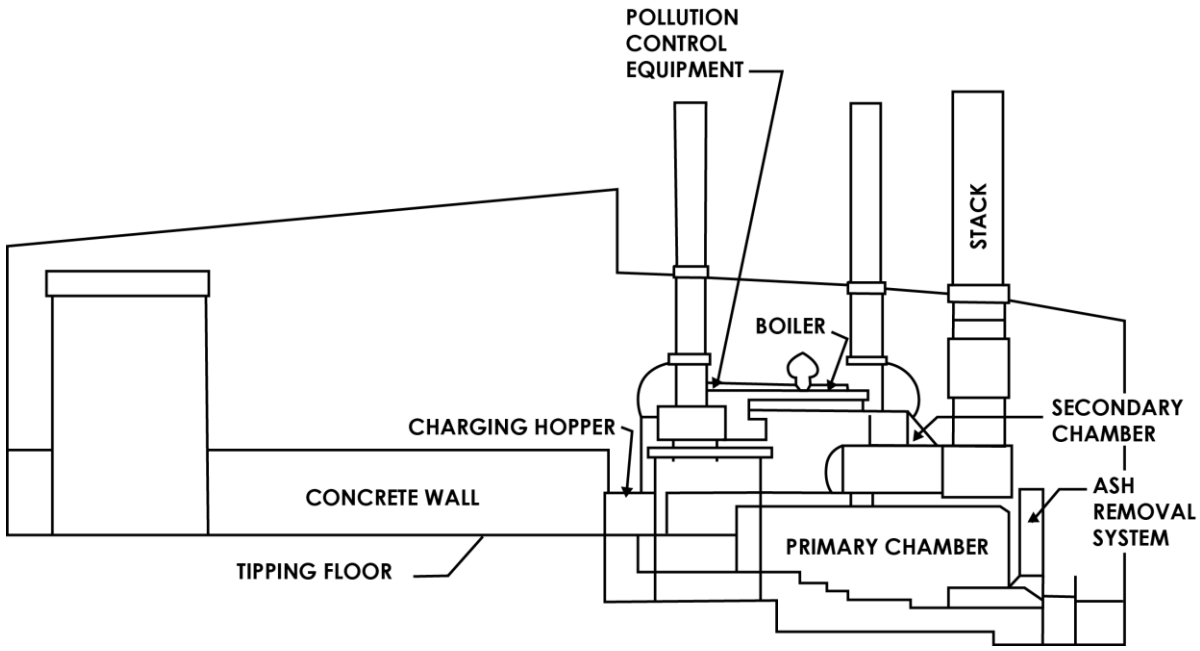
12.3.3 Modular Combustion

A modular incinerator is a type of mass-burning, WTE unit which is prefabricated on a standardized modular basis in a factory Such units are shipped to the site in modules, ranging in design capacity from 10 to 200 tons per day, where they are installed. Several modules can be grouped together at a single location. These "off the shelf" units can often be less costly to fabricate than the larger mass-burn facilities which require more costly field erection. Modular plants can also typically be constructed in some 15 to 20 months.

Modular incinerators have been designed and constructed in the United States with different process configurations. Some units have been designed to incinerate solid waste under excess air conditions with either refractory furnaces or waste heat boilers or with waterwall boilers. A majority of most units, however, have been designed to operate under starved air conditions with refractory furnaces and waste heat boilers.

A cross-section view of a typical modular combustion unit is illustrated in Exhibit 12-2. A majority of modular facilities have a tipping floor and utilize a front loader for simplicity in waste storage and feeding. Combusting takes place in either two or three stages. First, solid waste, which is delivered to the facility, is fed into the initial combustion chamber using a ram-type feeder. A moving ram slides back and forth over fixed steps within the chamber, causing the waste to tumble down one fixed section of the grate to the next fixed section. The waste is then transformed into a low-Btu gas which is then combusted in the secondary chamber, where auxiliary fuel is often fired under excess air conditions. A discharge ram on the back end of the combustion chamber feeds this incinerated waste into an ash quench bath.

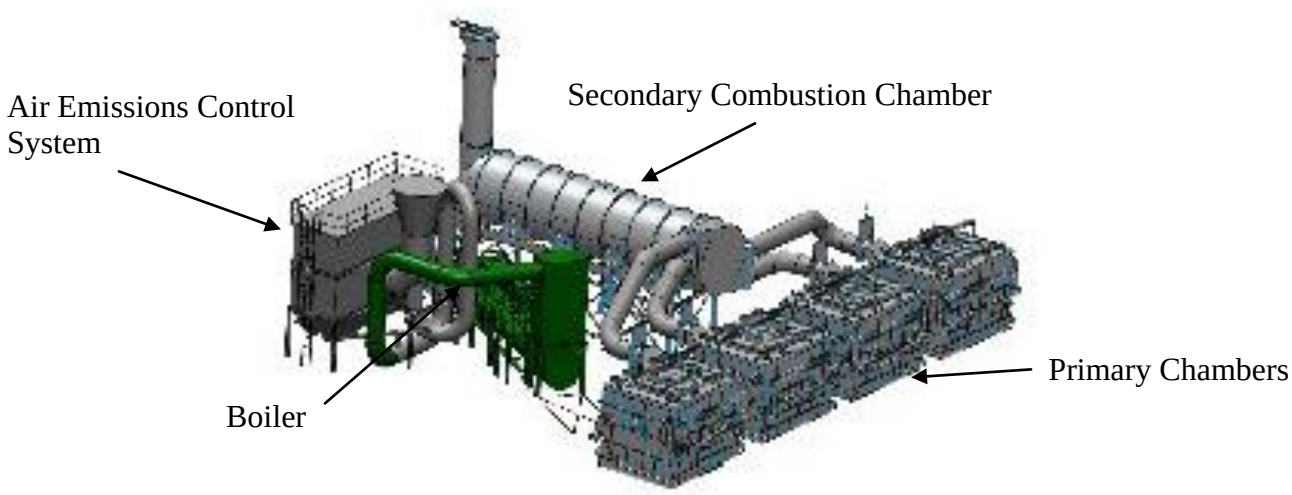
Exhibit 12-2. Cross-Section of Typical Modular Facility



The low-Btu gases produced by the combustion process in the first chamber are typically introduced into a secondary chamber where they are burned at temperatures ranging from 1,800 to 2,000°F. Heat energy is recovered by convection in waste heat boilers in this secondary chamber, although waterwall boiler units for the primary and secondary chambers have been constructed.

In recent years, several manufacturers have entered the modular plant marketplace using a batch oxidation process (BOS – Exhibit 12-3). The batch process integrates slow gasification and long exposure time at moderate temperatures followed by turbulent oxidation of gases at high temperature. After the waste is loaded into the primary chamber and sealed tight, an auxiliary burner is ignited to raise temperatures to about 200°C. The interior temperature is then monitored with controls and maintained by allowing sub-stoichiometric amounts of air into the chamber during the gasification process. The combination of relatively low temperatures and only sub-stoichiometric amounts of air in the primary chamber during gasification do not disturb the gasification bed, which is said to minimize particulate emissions, heavy metals, and many combustion gasses. Depending on the waste type and system layout, the waste reduction process in the primary chamber will take approximately 10 to 15 hours.

Exhibit 12-3. Cross-Section of Batch Oxidation System, Modular Facility



Source: Waste2Energy, Inc., 2009

Emissions produced during the gasification process pass through to the preheated secondary chamber also called an "afterburner" where these emissions are thermally treated. As the gasses from the primary chamber enter a preheated secondary chamber, auxiliary burners and excess oxygen create a very turbulent high temperature environment (typically between 850°C and 1,200°C). For most applications within the European Union (EU) 850°C is the required minimum, though 1,100°C is required for halogenated wastes, and in North America, 982°C is usually required. Additionally, residence time in the secondary chamber is important for proper destruction of emissions from the primary chamber. In both the EU and North America, a minimum residence time of 2 seconds is required. Operation of these units is subject to stringent

USEPA and state air emission regulatory standards and permitting. Operating permit conditions typically require continuous air monitoring and routine reporting to demonstrate compliance.

There have been many more modular WTE incinerators constructed in the United States than either the mass-burn or refuse-derived fuel systems. In 1977, the first modular incinerator began operations in North Little Rock, Arkansas to produce steam for the Koppers Industry's Forest Products Division. Since that time, some 50 modular systems have been built in the United States (Exhibit 12-4), almost exclusively to produce process steam for neighboring industries. Some of these systems, for example, a plant in Fosston, Minnesota, have utilized the community's solid waste as a fuel to produce steam to a district heating loop during the winter, and electricity during the summer. Many of the newer facilities have incorporated electric production capability.

Exhibit 12-4. Comparison of Active Modular Combustion Facilities

Location	Startup	Design Capacity (tons/day)	Energy Generation	Capital Cost ($ millions)
Auburn, ME	1992	200	Steam	4.0
Joppa, MD	1988	360	Steam	10.0
Pittsfield, MA	1981	360	Steam	10.8
Alexandria, MN	1987	80	Steam/Electric (0.5 MW)	4.2
Fosston., MN	1988	80	Steam	4.5
Perham, MN	1986/2002	116	Steam/Electric (2.5 MW)	6.0
Red Wing, MN	1982	90	Steam	2.5
Fulton, NY	1985	200	Steam/Electric (4 MW)	14.5
Almena, WI	1986	100	Steam/Electric (0.27 MW)	2.7
Husavik Municipality, Iceland	2006	20	Steam	3.5
Scotget, Scotland	2009	180	Electricity	40.0
Turks and Caicos Island	2008	4	None	1.0
U.S. Air Force, Wake Island	2009	1.5	None	0.5
U.S. Department of Defense, Kwajalein Atoll	2007	32	None	5.0

Modular combustion units offer a lower capital cost and simplicity than the larger field-erected mass-burning systems for communities considering WTE systems. These systems are generally reliable and are backed by many years of successful operating experience. The newer batch oxidation systems (BOS) appear to offer substantially lower costs of operations and maintenance. For example, the manpower required to operate these systems is generally minimal with one worker required to load the primary chamber and discharge the ash stream within an hour. Many suppliers claim nearly complete burn out between energy recovery and recycling. The ash remaining is reported to be about 3 to 8% of the original volume (depending on waste composition). Lastly, these systems are modular and can be easily increased or decreased in size.

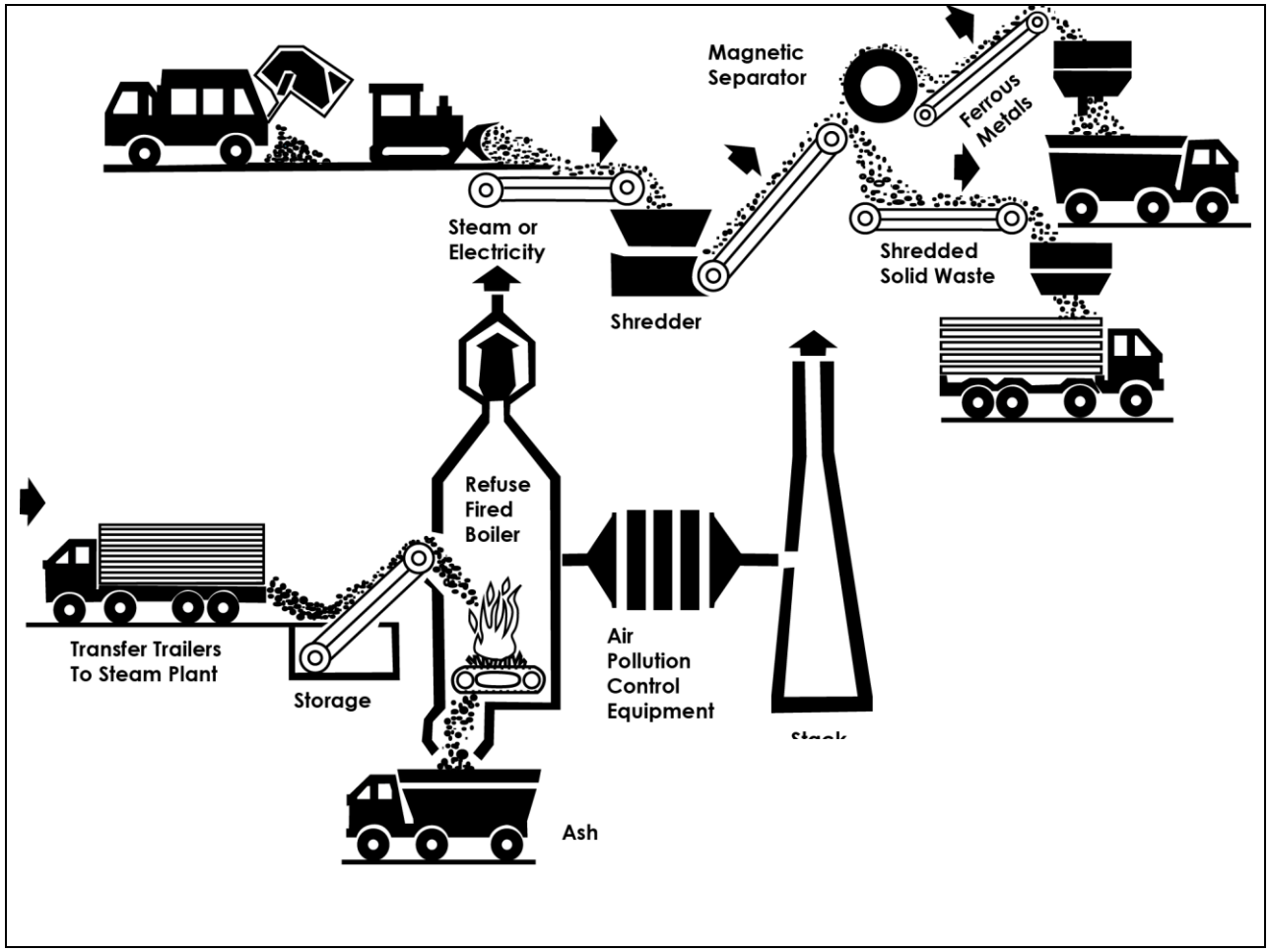
Based on our experience with similar modular plants, SCS would anticipate that an experienced staff of six (6) to nine (9) people, spread over three shifts per day, is required to continuously operate a plant of the size potentially applicable to the Town or region.

12.3.4 Refuse-Derived Fuel Systems

Several American corporations have developed technologies that pre-process solid waste to varying degrees to separate the non-combustibles from the waste stream. By undergoing processing steps of hammering, shredding, or hydropulping, the combustible fraction of the waste is transformed into a fuel, which can then be fired in a boiler unit specifically dedicated for this type of refuse-derived fuel (RDF), or co-fired with another fuel, such as coal, shredded tires, or wood chips. The fuel produced can thus be utilized in equipment that can have higher efficiencies than mass-fired units resulting in greater electricity or steam output. However, the front-end processing of the solid waste into a fuel has been one of the problem areas of this type of refuse disposal technology.

Since the early 1970's, there have been several dozen facilities which have been constructed in the United States to process solid waste into a RDF through the use of dry processing systems. Such dry processing systems are classified according to the type of products that can be produced: fluff RDF, densified RDF, and powdered RDF. A cross-section of a typical RDF system is illustrated in Exhibit 12-5.

Exhibit 12-5. Cross-Section of Typical RDF System



Somewhat associated with RDF facilities are materials processing facilities, which include size reduction, screening and recovery systems, and then additional equipment to reduce the moisture in the resulting RDF to improve its heating quality. For example, in the Chemtex-Entsorga HEBIOT process ("high efficiency biological treatment") an aerobic digestion module is utilized to drive off the moisture from waste that has been shredded. This volume reduction technique reported reduced the incoming waste by 80% with the remaining 20% being disposed of in a landfill. In essence, except for this latter function, this process is very similar to "dirty" materials processing facilities used for volume reduction at many front-end processing facilities at RDF facilities. In Europe, there is a substantial market for such mechanical biological treatment plants offered by Ensorga, which has been driven by the European Union's Landfill directive that restricts the landfilling of biodegradable waste and stipulates a pre-treatment of MSW. Many of these facilities are co-located with cement mills, RDF power plants, or even coal-fired power plants.

Common disadvantages associated with such mechanical biological treatment plants include:

- Noise and odor associated with the dirty MRF processing;

- Air emissions from burning the RDF product;
- Concerns with contamination and quality of the resulting biological compost product; and,
- The need for additional infrastructure to utilize the generated power.

12.4 ALTERNATIVE WC TECHNOLOGIES

The alternative waste conversion technologies are numerous and can be grouped many ways, but for this discussion, SCS has grouped technologies by three major processes that include:

- Thermal
- Biological
- Bio-Chemical

Within these groups are many methods and technologies that have been developed to extract different benefits from the processed waste stream including;

- Gases for power production;
- Gases for feedstock for vehicular fuels;
- Basic chemicals for use as a raw feedstock;
- Compost/ soil amendments; and,
- Slag for use an alternative building material.

A brief description of the main technologies in each of the three groups is presented below with discussion as to potential relevancy to the Town and region, benefits, estimated costs, and potential advantages and disadvantages.

12.4.1 Thermal

The thermal technologies are based on taking the solid waste and processing it under moderate to very high temperatures in a closed reactor vessel, sometimes under pressure and with or without the introduction of air or steam. Depending on the particular process, traditional recyclables may be removed at the front end of the process or during the process stages. The predominant processes are pyrolysis-gasification and autoclaving.

12.4.1.1 Pyrolysis - Gasification

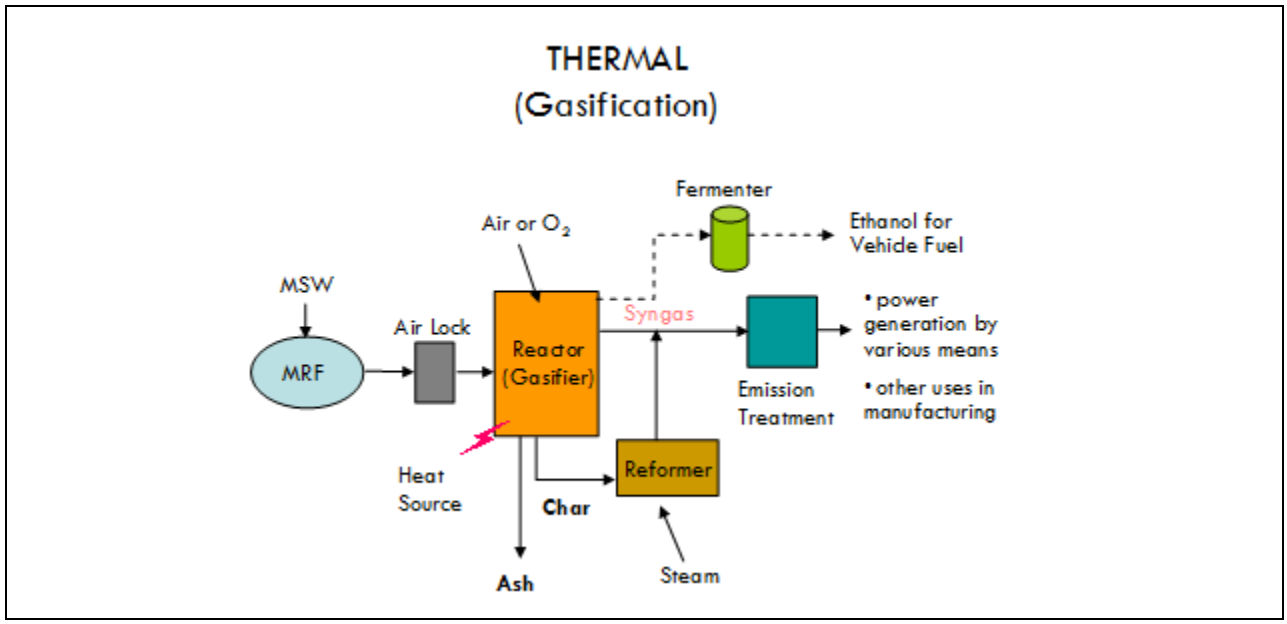
In a pyrolysis process air is excluded from the reactor vessel and results in the waste decomposing into certain gases (methane, carbon dioxide, and carbon monoxide), liquids (oils/tar), and solid materials (char). The proportions are determined by operating temperature, pressure, oxygen content, and other conditions. Because there is little to no air or oxygen, the waste does not combust as it breaks down (there are no flames).

When the amount of air in the process is less than that required to support combustion, but greater than in a pyrolysis process, the process is termed *gasification*. This process is typically

used to achieve a different balance of the gaseous by-products, mainly the production of a hydrogen (H)-rich gas with smaller quantities of carbon monoxide (CO), methane (CH_4) and carbon dioxide (CO_2). The refined gas, primarily H and CO, is termed *syngas* and has many direct applications such as powering a turbine to produce electricity and potentially for use as a feedstock to produce alternative vehicular fuel (ethanol), or other chemical compounds. Most of these processes require an external heat source under normal operating conditions. This is usually hot, clean air that captures heat from the downstream gas combustion process.

A basic gasification process is shown in Exhibit 12-6. Gasification processes have attracted much interest because the process is inherently more efficient than a combustion-based process, the syngas is a relatively clean energy source and the plant may generate less troublesome air emissions overall.

Exhibit 12-6. Basic Gasification Process

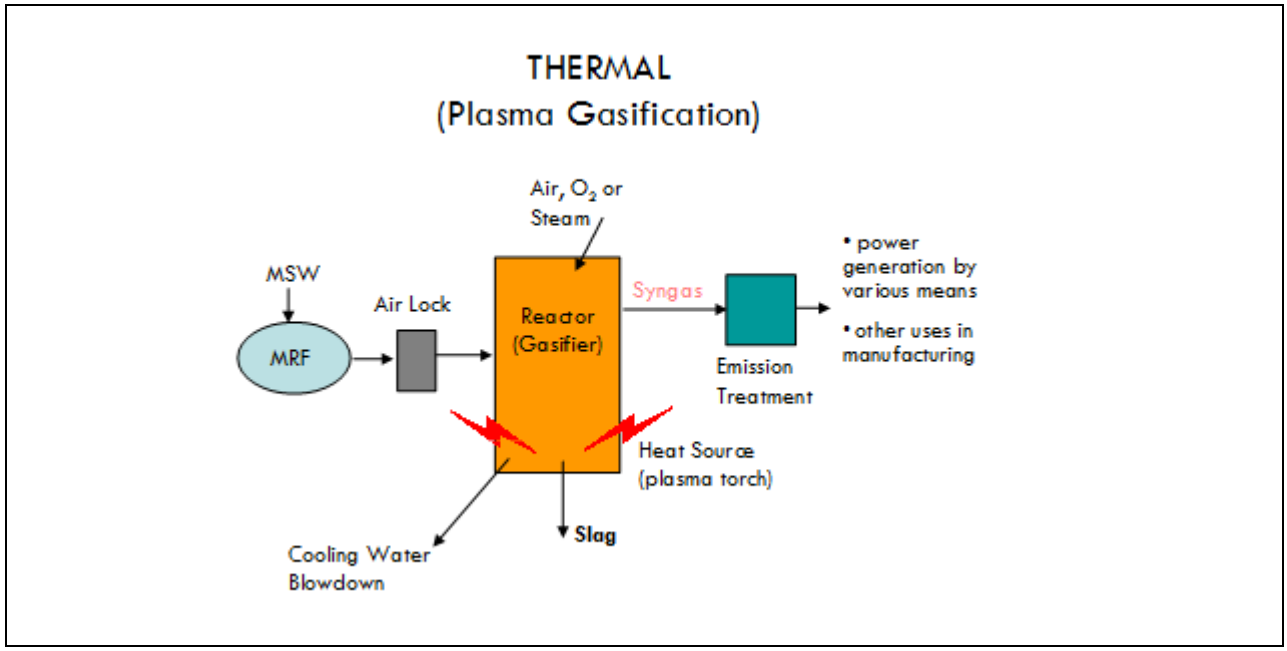


A relatively recent development for solid waste conversion using the gasification process, that employs a unique heating source, is known as a plasma arc converter. Although there are many variations, a typical plasma arc converter uses an array of plasma torches to generate temperatures in the reactor of more than 5,000°C. This extremely high temperature, coupled with a gasification environment has shown potential in small laboratory test units to achieve a very high efficiency in decomposing the organic fraction of the waste to syngas, while generating a slag material from the inert fraction. The slag has potential for use as a substitute ingredient in potentially many building materials, including concrete structural elements (e.g., wall panels and blocks, etc.) and asphalt.

A plasma is an ionized gas that results when a basic gas, such as nitrogen or air is passed through an electrical arc struck between two electrodes. The electrodes are constructed into a torch that directs the plasma arc. The intense heat created by the arc can be used to treat many materials,

including MSW. Plasma arcs were commercialized in the metallurgical industry where the high temperatures produced in the reactor vessel (potentially up to 10,000°C) are used to create special alloys. Some of the electric power generated by the plant is siphoned off to power the torches. The basic plasma arc process is shown in Exhibit 12-7.

Exhibit 12-7. Basic Plasma Gasification Process

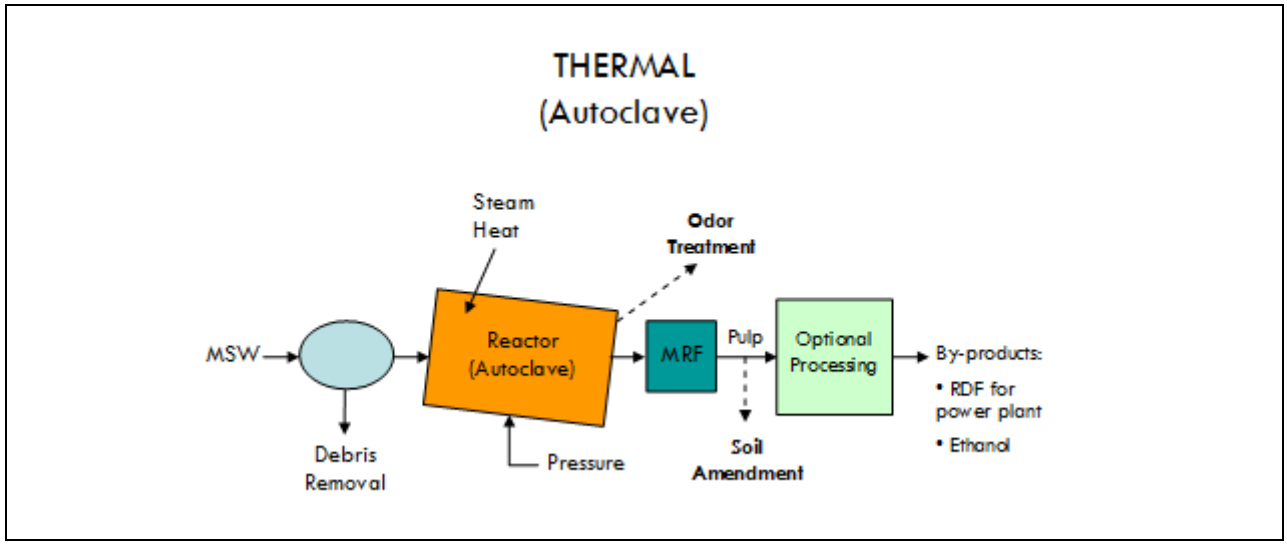


12.4.1.2 Autoclave

The basic autoclave process has been in commercial use for decades, primarily in the medical field for sterilizing instruments, some manufacturing uses and in the sterilizing of medical wastes. In an autoclave process for solid waste, mixed MSW is fed into a reactor vessel where it is subjected to heat, pressure and agitation. The reactor conditions cause the organic fraction of the waste (i.e., food scraps, fiber/paper products and vegetation) to break down into a pulp-like substance that potentially has reuse applications depending on the degree of post-processing selected.

The pulp has been demonstrated with a few systems to be a useful soil conditioner and also is being tested for use as feedstock for the production of ethanol, an alternative vehicle fuel and in the production of a RDF for combustion in power plants. The process also claims to provide a higher quality recyclable product. Plastic recyclable materials are softened and occupy less volume downstream. Product labels on glass, plastics and metals are totally removed and these materials also are cleaned and sterilized. A basic autoclave process is shown in Exhibit 12-8.

Exhibit 12-8. Basic Autoclave Process



12.4.2 Biological

There are two types of biological processes being utilized for WC. These include the anaerobic and aerobic process technologies. The following paragraphs briefly describe these technologies.

12.4.2.1 Anaerobic Process

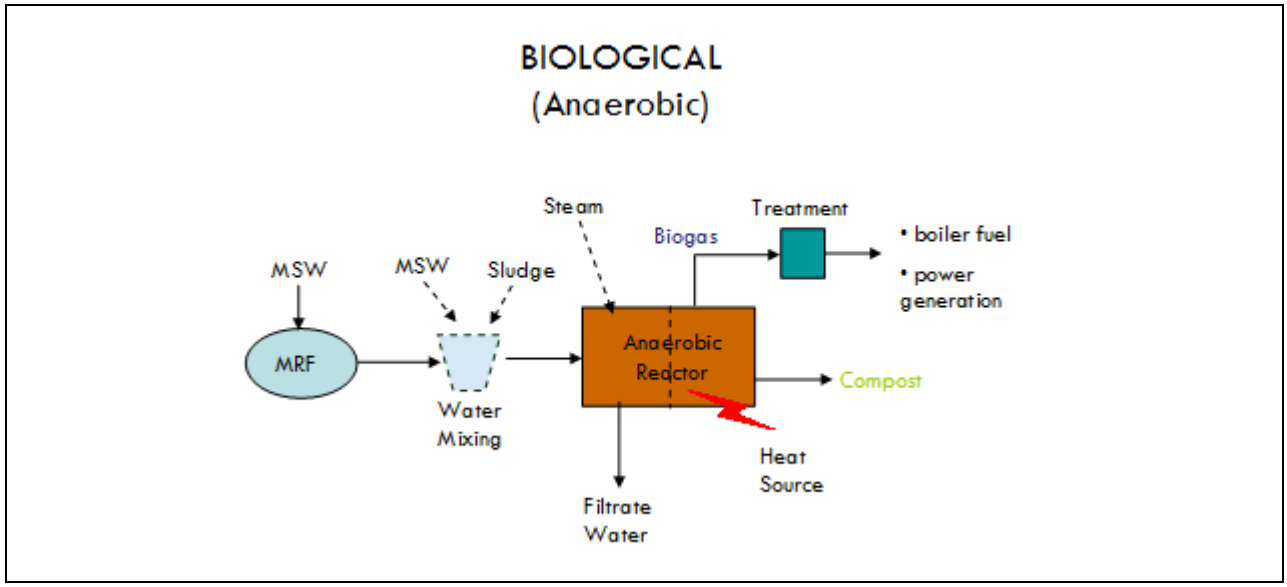
Anaerobic digestion is the bacterial breakdown of organic materials in the absence of oxygen. This biological process produces a gas, sometimes called biogas, principally composed of methane and carbon dioxide. The anaerobic process is often used to treat organic wastes other than nonsegregated MSW, and that is where it is used the most. This anaerobic process is used to digest sewage sludge (i.e., biosolids – produced from treated sanitary sewage), yard vegetation, agricultural wastes (both animal and plant) and some industrial waste sludge. The number of plants processing these materials is currently in the thousands worldwide.

The anaerobic digestion process occurs in three steps:

1. Decomposition of plant or animal matter by bacteria into molecules such as sugar.
2. Conversion of decomposed matter to organic acids.
3. Organic acid conversion to methane gas.

Depending on the waste feedstock and the system design, biogas is typically 55 to 75% methane. A basic anaerobic process is shown in Exhibit 12-9.

Exhibit 12-9. Basic Anaerobic Process



12.4.2.2 Aerobic Process

The aerobic process relies on a continuous supply of air to be mixed in with the waste material. Again, the waste is ground up into pieces. Recyclable materials are removed before this process. In a typical plant the waste is ground up and formed on an outdoor pad into long piles called windrows. The windrows are agitated a few times per week to allow all parts of the pile to be exposed to air. The agitation and aerating process can also be conducted in a vessel into which air is forced. The aerobic environment supports a different, but also common microorganism that, like the anaerobic process, feeds on the organic fraction of the waste. The waste is converted to by-products that include CO_2, water vapor and compost. Typically a site had to be located in a rural area; otherwise, the odors from the process could become a nuisance.

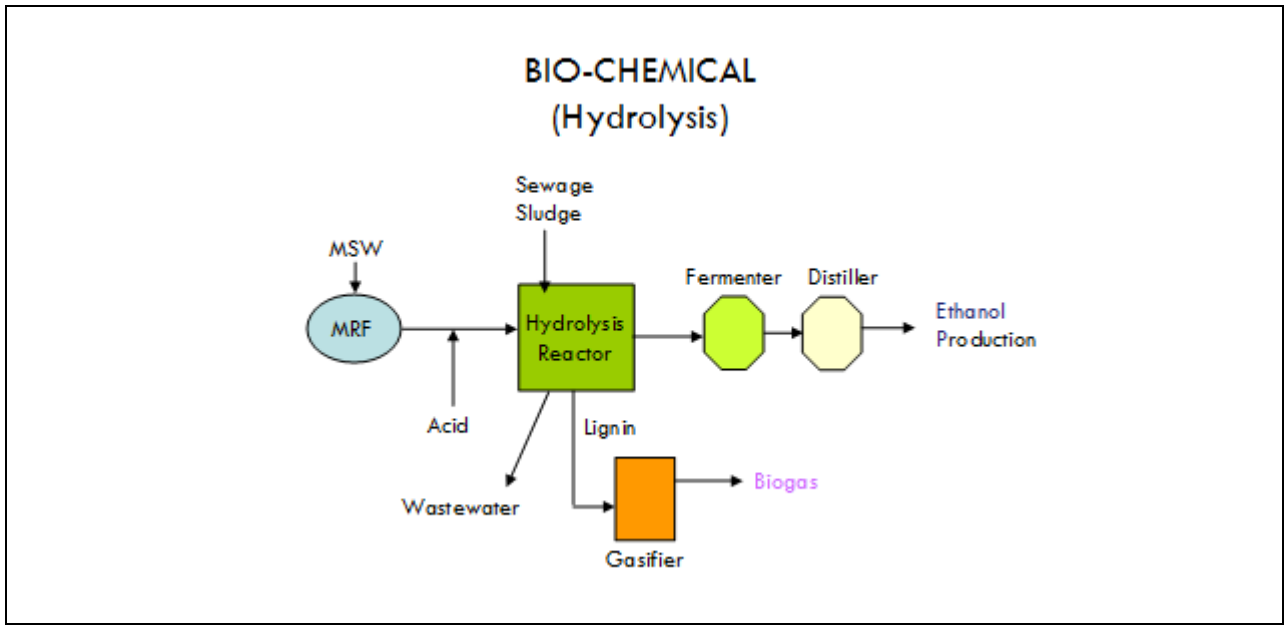
12.4.3 Bio-Chemical

The bio-chemical process is based on breaking down the cellulosic part of the organic fraction of the waste stream. This would include certain foods (e.g., vegetables, fruits), paper products and yard vegetation. Biosolids can also be added as a waste material. All other materials in the waste stream should be removed prior to the process.

In the process, following drying and shredding of the waste, the prepared waste stream is mixed with water and sulfuric acid in a closed reactor vessel. This causes a reaction that in conjunction with common bacteria already in the waste, breaks down the material into sugar compounds and a by-product known as lignin. There are some companies that are testing natural enzymes, instead of the strong acid chemical, to initiate this reaction.

The resulting sugar compounds and water are sent to a fermentation unit where yeast is added. The yeast reacts with the sugars to convert them to alcohol. The alcohol mixture is then heated and distilled to remove the solids. The resulting distilled alcohol (grain alcohol or ethanol) can be used as fuel. The lignin by-product is sent to a gasifier where it is used to produce heat for the drying process or can potentially be further processed for use as a fuel substitute in power plants. A basic bio-chemical process is shown in Exhibit 12-10.

Exhibit 12-10. Basic Bio-Chemical Process



12.5 STATUS OF COMMERCIAL OPERATING WTE AND WC FACILITIES

12.5.1 Waste-to-Energy

At the time of this report, there are about 1,300 WTE facilities worldwide. Large numbers are located in Europe (440) primarily because of the European Union's directive that requires a 65% reduction in the landfilling of biodegradable MSW. Asian countries (Japan, Taiwan, Singapore, and China) have the largest number (764) of WTE facilities worldwide. All of these countries face limited open space issues for the siting of landfills and have large urban populations. One of the largest current markets for WTE plant construction is in China, which is currently the fourth largest user of WTE worldwide.

In the U.S., there are currently 89 WTE plants (Exhibit 12-11) operating in 25 states managing about 7% of the nation's MSW, or about 85,000 tons per day. This is equivalent of a base load electrical generation of approximately 2,700 megawatts to meet the needs of more than two million homes, while servicing the waste disposal needs of more than 35 million people.

Exhibit 12-11. U.S. WTE Plants by Technology

Technology	Operating Plants	Daily Design Capacity (Tons per day)	Annual Capacity (Million tons)
Mass Burn	65	71,354	22.1
Modular	9	1,342	0.4
RDF – Processing and Combustion	10	15,428	4.8
RDF – Processing Only	5	6,075	1.9
RDF – Combustion Only[1]	5	4,592	1.4
Total U.S. Plants	94	98,791	30.6
WTE Facilities	89	92,716	28.7

[1] Plants that do not generate power onsite.
Source: Integrated Waste Management Services Association, 2010.

12.5.2 Waste Conversion

The following sections summarize existing information on commercial operating WC plants worldwide.

12.5.2.1 Plasma Arc Gasification

As shown in Exhibit 12-12, there are four operating plants utilizing MSW as feedstock. Only one of these, the Utashinai City plant, can be considered commercial; the others have been only operated as pilots or intermediately operated for testing purposes. A pilot plant in Ottawa, Canada is currently being tested by Plasco Energy and has only been intermediately operated with a maximum continuous runtime of 36 hours using a pre-sorted, post-consumer waste stream as feedstock. Plasco is currently in the process of converting this plant to commercial operations, having successfully negotiated an operating contract with the City of Ottawa.

Exhibit 12-12. Commercial Operating Plasma Arc Gasification Facilities

Location	Throughput (Tons per day)	Owner/ Operator	Technology Supplier	Start of Operation	Feedstock
Yoshi, Japan	25	Hitachi Metals, Ltd.	Westinghouse Plasma Corp.	1999	MSW
Utashinai City, Japan	200	Hitachi Metals, Ltd.	Westinghouse Plasma Corp.	2003	MSW
Mihami-Mikata, Japan	22	Hitachi Metals, Ltd.	Westinghouse Plasma Corp.	2002	MSW Biosolids
Ottawa, Canada	94	Plasco Energy	Plasco Energy	2007	Shredded MSW Shredded Plastics

Source: SWANA, Waste Conversion Technologies, 2011; SCS files.

12.5.2.2 Pyrolysis Plants

As shown in Exhibit 12-13, the use of pyrolysis technologies to process MSW has occurred mainly in Japan and Germany where these plants reportedly process about two million tons of materials per year.

Exhibit 12-13. Commercial Operating Pyrolysis Facilities Using MSW

Location	Throughput (Tons per Day)	Technology Supplier	Start of Operation
Toyohashi City, Japan	440 77 (Bulky Waste)	Mitsui Babcock	2002
Hamm, Germany	353	Techtrade	2002
Koga Seibu, Japan	286 (MSW and Biosolids)	Mitsui Babcock	2003
Yame Seibu, Japan	242 55 (Bulky Waste)	Mitsui Babcock	2002
Izumo, Japan	70,000 TPY	Thidde/Hitachi	2003
Nishiburi, Japan	210 63 (Bulky Waste)	Mitsui Babcock	2003
Kokubu, Japan	178	Takuma	2003
Kyouhoku, Japan	176	Mitsui Babcock	2003
Ebetsu City, Japan	154 38 (Bulky Waste)	Mitsui Babcock	2002
Oshima, Japan	132	Takuma	2003
Burgau, Germany	154	Techtrade	1987
Itoigawa, Japan	25,000 TPY	Thidde/Hitachi	2002

Source: SWANA, Waste Conversion Technologies, 2011; U.S. Department of Energy, 2011, "Draft Environmental Assessment for Oneida Seven Generation Corporation, Energy Recovery Project, Green Bay, WI.

There are no commercially operated facilities in the U.S., although a pilot facility was operated in Green Bay, WI using American Combustion Technology pyrolytic systems for testing purposes. Oneida Seven Generations, Inc. has plans to construct a pyrolysis facility using 148 tons per day of MSW and 61 tons per day of plastic waste in Green Bay, WI.

There were a number of full-scale MSW pyrolysis demonstration plants, which were constructed in the U.S. during the late 1970s and early 1980s by Monsanto and Union Carbide. These facilities were not commercially successful and were eventually shut down. Similarly, a 91 TPD MSW pyrolysis facility was constructed in New South Wales, Australia in 2001 by Brightstar Environmental. This facility incorporated the use of an autoclave process where the organic fraction was dried before being sent to a pyrolysis vessel. This facility operated for only 6 months and was shut down due to its failure to meet permitted conditions.

12.5.2.3 Anaerobic Digesters

There are nearly 240 anaerobic digesters (AD) facilities around the world with operating capacities greater than 2,500 tons per year. These plants process not only the organic fraction of the MSW waste stream but also organic waste from food industries and animal manure. Europe leads in the number of AD plants and total installed capacity principally due to the European Union Directive that requires member states to reduce the amount of landfilled organics by 65% by 2020. As shown in Exhibit 12-14, there are more than 120 plants processing the organic fraction of MSW in Europe of about 4.6 million tons per year. The principal technologies used around the world are provided by the following companies: Dranco, Kompogas, Linde, RosRoca, Valorga, BTA, and Cites.

Exhibit 12-14. European Countries With AD Facilities

Country	No. of Plants	Country Capacity (Tons per year)
Germany	55	1,250,000
Spain	23	1,800,000
Switzerland	13	130,000
France	6	400,000
Netherlands	5	300,000
Belgium	5	200,000
Italy	5	160,000
Austria	4	70,000
Sweden	3	35,000
Portugal	3	100,000
United Kingdom	2	100,000
Denmark	2	40,000
Poland	1	20,000
Total	127	4,605,000

Source: Levis, J.W., et. al., "Assessment of the State of Food Waste Treatment in the U.S. and Canada," Waste Management 2010 August-September 30 (8-9) 1486-94.

Currently, there is only one commercially operated AD facility in the U.S, which is located on the campus of the University of Wisconsin-Oshkosh. It processes about 6,000 tons of yard and food wastes per year. Further, an AD facility digesting source-separated organics has been commercially operating in Toronto, Canada for a number of years processing about 90,000 tons per year. A second AD facility is currently under construction in Toronto and should be operating within a year. Similar AD facilities have been authorized by Quebec City and Montreal with additional facilities funded in the Province of Quebec.

Based on our understanding of the AD process and results of numerous feasibility and pilot studies, SCS understands an AD operation of the size required to process the Town's waste would require as few as three (3) to four (4) staff.

12.6 BENCHMARK METRICS

12.6.1 Summary of Current Town Solid Waste Statistics

As described in Section 2, at the writing of this report, the Town generates and disposes approximately 17,000 to 18,000 tons per year of MSW and yard waste. Based on census data, population projections, and current disposal practices, this volume is anticipated to reach approximately 21,500 tons in 15 years and 27,400 tons in 30 years. These current and future generation and disposal statistics equate to a design operating range of 55 to 90 tons per day, assuming 6 days per week operations, while allowing 1 day per week for maintenance, repair, and residuals management. As described, the Town has historically paid a tip fee of $57 per ton to the Orange County Landfill, and anticipates lower tip fees with consideration of other disposal options.

12.6.2 Minimum Waste Throughput Processing Capacity

12.6.2.1 Waste-to-Energy

As depicted in Exhibit 12-2 in Section 12.3.3 above, WTE facilities require significant waste throughput to be economically viable. For traditional WTE technologies, SCS typically projects a daily throughput capacity of at least 100 to 300 tons per day required to substantiate siting a new WTE facility. Such a facility would most likely consist of multiple, smaller capacity modules, on the order of 250 to 100 tons per day or, several smaller facilities located in different areas, and in both cases providing an aggregate capacity. Collaboration and regionalization is a must to support such technologies.

12.6.2.2 Waste Conversion

Based on SCS experience, typical WC technologies, including thermal, biological, and bio-chemical are represented to operate on a comparatively smaller scale. Between these types, generally, thermal technologies require more significant waste throughput to be economically viable. Due to lesser equipment and energy requirements, biological technologies can generally support smaller waste throughput.

12.6.2.2.1 Thermal

By a wide margin, the greatest amount of recent activity in WC technology is with the thermal technologies, dominated by the plasma arc conversion process. This is mainly due to its potential for large power production and overall reduced air emissions.

The lack of an operational track record for both large-scale and small-scale WC technologies suggests to SCS that a WC technology plant should more likely be planned initially as a small pilot-plant. A pilot plant, in SCS's opinion, based on proven laboratory and mini-pilot scale technology, would be no more than about 100 tons per day with the potential for scale-up should the technology be proven at the pilot stage and with regional collaboration.

The point here being, based on SCS's experience, the scalability of thermal WC technologies may never exceed pilot scale without regional collaboration and population growth in Chapel Hill.

12.6.2.2.2 Anaerobic Facilities

In Europe, the anaerobic process has been used successfully to process MSW. The sizes of these plants reportedly range from 3,000 tons per year (TPY) to 182,000 TPY. Converted to a daily capacity, and assuming a 6-day per week processing schedule, these capacities range from 10 tons per day to 580 tons per day.

As noted in the paragraphs above, there are several operating AD facilities in North America in the size range potentially generated by the Town. These facilities are successfully processing from about 15 to 250 tons per day of food and yard wastes diverted from residences, restaurants and businesses and converted into methane that is used to produce power.

12.6.3 Summary of Readiness for Commercial Operations

Some, but not all of the alternative WC technologies are ready for commercial operation. Exhibit 12-15 summarizes the technologies discussed herein and whether, in SCS's opinion, they are ready for pilot plant or commercial operation on a scale necessary to serve the Town or Region.

Exhibit 12-15. Summary of Main Processes

Process	Pre-Processing	By-Product	Primary Product	Pilot Plant Readiness	Commercial Readiness
Pyrolysis	High	Ash	Syngas/Oil	Yes	No
Gasification	Medium	Ash/Slag	Syngas/Char	Yes	No
Autoclave	Low	None/Recyclables	Pulp	Yes	Yes
Anaerobic Digestion	Medium/High	Filtrate Water	Biogas/Compost	Yes	Yes
Hydrolysis	High	Waste Water/Ash	Ethanol	Yes	No
Aerobic Digestion	Medium/High	None	Compost	Yes	Yes
Plasma Gasification	Claims Low/High	Slag	Syngas	Yes	No

As depicted, each of the seven technologies have demonstrated pilot plant readiness either nationally or internationally; however, only three of the technologies appear ready for commercial scale operations. These three technologies are the biological processes and the Autoclave process. With the exception of the autoclave, each of these technologies requires pre-processing requirements to remove potential contaminants from the incoming waste stream.

12.6.4 Capital and Operating Costs

As described, due to the relatively recent development of the alternative WC technologies, there are few, if any, full-scale operational plants in the U.S. Thus, there are not reliable figures readily available for capital and operating costs.

Two large, relatively recent studies were conducted as part of a detailed review of alternative waste conversion technologies in the U.S. The on-going studies were sponsored by Los Angeles County California, as continuation of that region's program initiated in 2003 to further address the regions acute problems with energy pricing and availability, air quality, traffic congestion and reliance on landfills that had limited useful life. The original study screened 27 technologies in the initial phase (2005) and reduced the list to 5 "finalists" technologies in the subsequent 2007 report. The finalists are planning to build small-scale demonstration plants to prove their respective technologies.

Although there have been other large alternative technology screening/evaluation studies conducted (i.e., New York City, 2004), the L.A. County studies seem to have the most detailed information on projected U.S.-based plant costs and economics. Exhibit 12-16 summarizes the project economics for five finalist biological and thermal alternative WC technologies that were developed as part of the L.A. County study in 2007.

Exhibit 12-16. Summary of Project Economics for Thermal and Biological Conversion Technologies(1)

Technology	(2)Annual Throughput (TPY)	Projected Design Capacity (TPD)	Capital Cost ($)	Capital Cost Per Ton ($/ton)	(3)O&M Costs ($)	Total Costs ($)	Estimated Annual Revenue ($)	Estimated Net Costs ($)	Calculated Tipping Fee ($/ton)	Tipping Fee Variation ($/ton)	Adjusted Tipping Fee ($/ton)
Biological (Anaerobic)	100,000	300	21,000,000	70,000	4,900,000	8,170,000	3,000,000	5,170,000	52	6	58
Thermal (autoclave)	51,100	200	35,000,000	175,000	9,000,000	13,100,000	8,400,000	4,700,000	92	0	92
Thermal (Pyrolysis Gasification)	80,000	242	30,140,000	125,000	5,580,000	7,740,000	3,280,000	4,460,000	56	2	58
Thermal (Gasification)	97,000	312	75,200,000	241,000	11,000,000	20,700,000	8,000,000	12,700,000	131	1	132
Thermal (Gasification)	138,000	413	56,600,000	137,000	8,260,000	14,200,000	6,300,000	7,900,000	57	12	69

(1)Excerpted and Summarized from the L.A. County, California Conversion Technology Evaluation Report, Phase II Assessment, dated October 2007.
(2)Tons per year (TPY), demonstration plant only.
(3)1st year costs only, does not include annual debt service.

The costs and economic summaries were provided by the selected technology vendors, using some pricing assumptions for specific items provided by the planning committee and applicable to southern California only. The consultant retained by L.A. County conducted an independent review of the costs and economics provided by the vendors and concluded that the figures provided were, in general, reasonable estimates that matched with the independent assessment's conclusions.

12.6.5 Tipping Fee Survey

Exhibit 12-17 compiles costs from the 2005 and previously discussed 2007 L.A. County studies. The middle column are tipping fees summarized from the economic projections rendered in the 2005 study, which had similar pricing and cost assumptions as in the 2007 follow-on study. Tipping fees in the 2005 study ranged from $61 to $197 per ton for the eight vendors. Two plants exhibited tipping fees in the $50 to $70 per ton range, while six were higher than that.

Exhibit 12-17. Summary of Economic Data(1)

Technology	(2)Projected Design Capacity (TPD)	(1)Calculated Tipping Fee ($/ton)	(3)Calculated Tipping Fee ($/ton)
Biological (Anaerobic)	100	93	58
Biological (Anaerobic)	100	67	--
Biological (Anaerobic)	100	197	--
Thermal (Autoclave)	--	--	92
Thermal (Plasma-Arc)	100	172	--
Thermal (Gasification)	150	61	58
Thermal (Gasification)	300	186	132
Thermal (Pyrolysis-Gasification)	100	129	69

(1)Excerpted and Summarized from the L.A. County, California Conversion Technology Evaluation Report, Phase I Assessment.
(2)Tons per year (TPY), demonstration plant only.
(3)Adjusted Tipping Fee from Exhibit 12-16, based on Phase II Study.

L.A. County considered a tipping fee in the range of $50 to $70 per ton, to be competitive with the tipping fees charged by the large regional landfills serving the area. Exhibit 12-17 indicates that two of the four thermal technologies and one anaerobic technology, provided costs that indicated the plant could offer a tipping fee in the $50 to $70 per ton range.

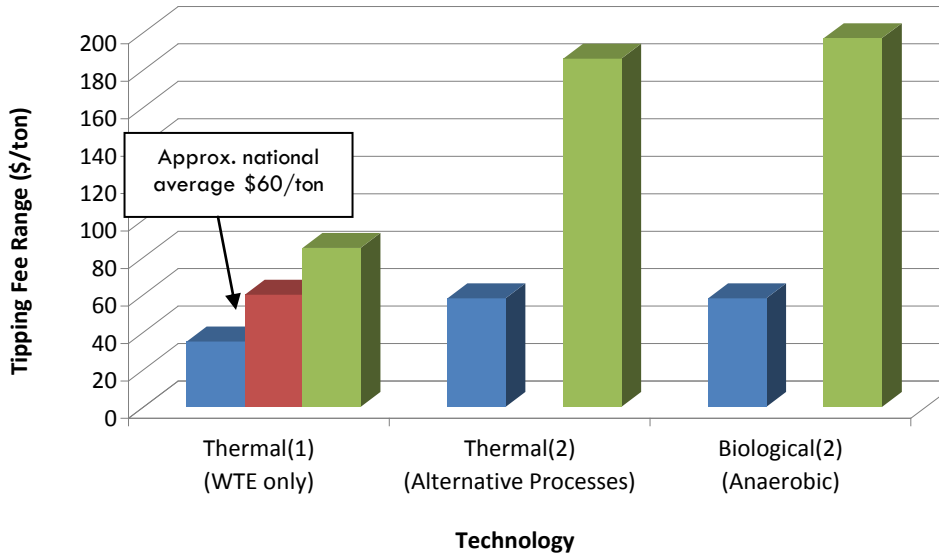
The difference in tipping fees from 2005 to 2007 probably reflects some differences in the pricing assumptions in individual studies including: proposed plant capacities were larger in 2007, and purchase pricing structure for the power produced was revised. It is also assumed that the market conditions for the development of these plants from 2005 to 2007 likely became more favorable as basic energy costs in the U.S. continued escalating.

12.6.6 Comparison to WTE Fees

Because conventional WTE plant technology has been in existence for decades, with hundreds of plants operating in the U.S. and abroad, comparative cost information is more established; although a completely new WTE plant has not been constructed in the U.S. in more than 10

years. Exhibit 12-18 presents a visual summary comparison of the tipping fees estimated for the alternative WC technologies in the L.A. County studies and the tipping fees for operating WTE plants. The graph shows that the appropriate "average" tipping fee for a WTE plant is about $60 per ton. The estimated "low" and "high" range is estimated to be from about $35 to $80 per ton, respectively.

Exhibit 12-18. Summary of Tipping Fee Range for Technologies



(1) Existing operating plants.
(2) Proposed demonstration, small-scale plants only. (8 plants total)

Legend
Low end
High end

The tipping fee ranges for alternative technologies are provided as a crude comparison to the WTE tipping fee. A large tipping fee range, from low to high, is evident. These plots reflect expected uncertainties and risks at the time of the studies, which would not be unusual for technology that is still in the development or pilot plant stages. Most WTE plants in the U.S. have a capacity anywhere from 500 to about 4,000 tons per day and this affords them a valuable "economy of scale" over the much smaller proposed alternative technologies.

Such a large range of tipping fees for alternative WC technologies may not actually be the case if a study were done today. Projected tipping fees are a function of many regional cost factors, including:

- Power production/ quality and quantity of syngas;
- Air emissions and treatment;
- Market for by-products;
- Downtime/ equipment reliability;
- Pre-processing requirements (sorting equipment, MRF, etc.);
- Operator experience;
- Financial contributions by vendor;

- Ancillary costs (transmission line, etc.); and,
- Contractual obligations.

However in SCS's opinion, these summary costs for alternative WC technologies suggest that tipping fee ranges are likely to be somewhat higher than a WTE plant, until enough of the plants are operating and hard costs are generated to validate that they can operate at a tipping fee comparable to a WTE plant.

12.6.7 Advantages and Disadvantages

All of the alternative WC technologies have some potential benefits and disadvantages. The over-riding aspect of all of the alternative WC technologies is that they are relatively new and thus do not have a "track record" from which one can derive hard conclusions related to actual, proven benefits and disadvantages. So, SCS can only postulate what the actual advantages, disadvantages, and economics might be. This exercise is based on assessing the information available from vendors, review of operational history for some very small-scale pilot plant facilities that may have operated intermittently, and evaluation of these technologies that are processing waste streams other than a normal mixed municipal solid waste.

Exhibit 12-19 summarizes the advantages and disadvantages of the alternative technologies and the WTE technology. We offer the following generalized conclusions, in addition to the comments in the table, about the viability of the technologies:

- **Biological (anaerobic).** Commercial scale proven at smaller capacities (i.e., 200 to 300 tons per day) in Europe. Developing a consistent market for the compost by-product is a major challenge and affects the operating economics. Only a few small scale plants are currently planned in the U.S.

- **Thermal.** Generally unproven at a commercial scale. One small pilot facility (85 tons per day) is operating in Canada. A complex process that must be optimized to provide the desired high-quality synfuel. There is much planning activity in the industry and in the next 5 years there will likely be some operational plants to better demonstrate the potential scalability and viability of these technologies.

- **Bio-Chemical.** Unproven at a commercial scale. A few plants have been planned, but have been delayed. Tied to the dynamic market for ethanol and competition with many other processes that do not use MSW.

Exhibit 12-19. Advantages and Disadvantages to Waste Processing Technologies

Process	Advantages	Disadvantages
Thermal – Pyrolysis / Gasification	Potential for high power production, high conversion	Untested, possibly high O&M costs, ash disposal
Thermal – Autoclave	Provide higher quality recyclables	Lack of market for compost
Biological – Aerobic	Proven, "low" tech. Emissions less of a concern.	Some odor; Lack of market for compost, low conversion
Biological – Anaerobic	Low emissions, low odor	Lack of market for compost
Plasma Gasification	Potential for high power production, high conversion	Untested, possibly high O&M costs, safety concerns, slag market (?)
Bio-Chemical (Hydrolysis)	Fuel production, biosolids processing	Untested, treats only cellulosic part of waste
WTE Plant	Proven large-scale technology	Large volumes of unusable ash, costly air emission control systems

12.7 RECOMMENDATIONS TO POSITION THE TOWN FOR POTENTIAL WTE AND WC TECHNOLOGIES

As the Town moves forward on its strategic planning initiative, SCS makes the following recommendations to help position the Town with relation to WTE and WC technologies:

- Many of the WTE and WC (thermal) technologies appear to be cost prohibitive with the current and projected MSW waste flow of the Town. The capital and pre-processing costs of these technologies, at the current time, appear to be cost prohibitive to reasonably recover the initial necessary investments compared to other solid waste management alternatives. It is our opinion, therefore, that regional efforts will be necessary to secure the desired waste flow to provide economies of scale for these technologies.

- Consequently, we would recommend that the Town implement a "wait and see approach" as for WTE and WC (Thermal) technologies offered in the U.S. marketplace. As noted in this report, many of these technologies are currently unproven on the commercial scale in the United States. However, firms like Entsorga, Harvest Power, and Plasco are rapidly progressing in finalizing plans to commercialize their technology. Construction and subsequent observation of these plants will provide much needed detailed capital and operating information to support the Town's decision making.

- Based on its projected economy of scale and initial investment requirements, the WC technology that may be most applicable to the Town, at this time, would be anaerobic digestion. This technology has proven to be successful in the processing of organics and MSW both in Europe, and now in North America at the waste flow level generated by the Town. The technology allows for scalability if other neighboring

localities decide to collaborate on the project in the future. The biogas produced could provide a valuable energy asset for Town facilities.

Capital needs required to construct and operate an anaerobic digester operations include: an organics receiving area(s), reactor chamber(s) (i.e., enclosed vessel), and processing equipment (i.e., wheel loader or conveyors). One initial challenge to implement this technology; however, is that the Town would need to initiate some form of separate organics collection, or post collection segregation, similar to what has been instituted by the City of Toronto. For example, under its "Green Bin Program," the City allows participants (residential and multi-family residents) to place organics (e.g., food wastes, soiled paper towels and food packaging, coffee grounds, etc.) out for separate collection along with refuse and recycling. The City provides roll-carts for residential customers while multi-family complexes are provided either bulk bins or roll-carts with residents given in-unit organics containers to collect their organics. The City has provided an extensive public education and outreach program. Should the Town consider a similar organics program, it is expected that organic wastes collection be carefully considered for its application towards and anaerobic digester operation.

- It is SCS's recommendation that the Town continue to pursue potential synergies between innovative technology vendors, local institutions of higher education, and professional associations to attract interest in fostering further feasibility studies and/or development of pilot studies. This recommendation is more fully discussed in the following section of the Report.

13.0 ALTERNATIVE TECHNOLOGIES – COLLABORATION WITH AREA INSTITUTIONS

13.1 UNIVERSITIES

Another waste management option for the Town is to pursue the implementation of Waste Conversion (WC) technologies in collaboration with area universities. Chapel Hill is located in the Research Triangle, so named in 1959 with the creation of Research Triangle Park, a research park between Durham and Raleigh. "The Triangle" is anchored by Duke University (Duke), North Carolina State University (NCSU), and University of North Carolina at Chapel Hill (UNC). Each university has its distinctive character and long-term sustainability program.

The following section briefly includes a general summary of current sustainability and solid waste management programs at the three universities and initial discussions with their sustainability directors to gauge the level of interest in collaborating with the Town on WC technologies. Several of the projects described below provide flagship examples of the possibilities that may spring from successful collaboration between WC technology vendors, university research resources, and private industry. Particularly, SCS believes collaborative resources within the Town are optimal for development of anaerobic digestion of organic waste with cooperation from UNC Chapel Hill, based on recent collaborative success in this technology by Duke.

13.1.1 Duke University

Duke has developed a Climate Action Plan that will guide the University towards carbon neutrality by 2024. As part of that effort, Duke University established The Duke Carbon Offsets Initiative (DCOI) to help meet the University's carbon neutrality commitment. The DCOI's mission is to develop local, state, and regional carbon offset projects that yield significant benefits beyond greenhouse gas emission reductions. Benefits the DCOI looks for in projects are additional environmental and public health protection, job creation opportunities, energy savings, and habitat protection.

For example, Duke University and Duke Energy have partnered to pilot an innovative system for managing hog waste that will reduce greenhouse gas emissions, generate renewable energy, and substantially eliminate a host of pollutants and issues associated with the waste from swine farms, including odors, ammonia, nutrients and pathogens. This system is located at Loyd Ray Farms, an 8,600-head swine finishing facility in Yadkin County, NC [23]. It is intended to serve as a model for other hog farms seeking to manage waste and develop on-farm renewable power.

The project involves the capture of methane generated by the hog waste. Hog waste generated at the farm is directed into a lagoon which acts as an anaerobic digester. The decomposing hog waste generates methane gas which is captured and collected under a plastic cover over the lagoon/anaerobic digester. The gas collected under the digester cover is used to power a 65-kW microturbine, the electricity from which is used to support the operation of the innovative waste

23 http://sustainability.duke.edu/carbon_offsets/Projects/loydray.html

management system. Any electricity not needed to power the anaerobic digester operations is kept on the farm to support normal farm operations. Like a traditional waste lagoon, the remaining liquid waste flows to an aeration basin which treats the water to address ammonia and other residual pollutants so that it can be re-used for irrigation and barn-flushing.

The project is also creating carbon offset credits through the documented and verified destruction of the methane gas. These carbon offset credits are shared by Duke University and Google. The project also produces renewable energy credits (RECs) which Duke Energy counts towards its NC Renewable Energy and Energy Efficiency Portfolio Standard (REPS) requirements for the generation of electricity from swine waste.

Discussions with Ms. Tavey McDaniel, the University's Sustainability Director indicated that they would welcome discussions with the town on potential collaborative research on waste-to-energy (WTE) and WC technologies.

13.1.2 University of North Carolina at Chapel Hill

SCS met with representatives of UNC to review their current solid waste programs and initiatives, and to identify possible areas of collaboration with the Town. In 2010, UNC initiated a study team to evaluate alternative energy technologies and make recommendations of viable options. As part of a long-term Climate Action Plan (CAP), the University has committed to end the use of coal on campus by 2020, and is evaluating the switch to biomass and natural gas.

13.1.2.1 Landfill Gas

Currently, UNC is partnering with Orange County to utilize landfill gas (LFG) supplied from the County's landfill. The initial phase of this project in 2010-2011 constructed a pipeline from the landfill to the power plant and modified UNC's existing boilers to co-fire coal and LFG. In future phases of this project, as part of upgrades to the University's power supply system, the University is constructing a new campus power plant to burn LFG with the gas transported via an extension of this pipeline from the landfill.

13.1.2.2 Biomass Feedstock Implementation

Furthermore, UNC has conducted pilot studies with their boilers to co-fire biomass in the form of torrefied wood pellets. The goal of these studies is to evaluate various feedstock, integrating the biomass processing and handling with boiler operations, and resulting energy potential. The results of these studies are under consideration and further studies are in discussion.

Based on these ongoing initiatives at UNC and the current state of many of the WTE and alternative WC technologies summarized in Section 12, collaboration with the Town to initiate another large-scale strategy (e.g., mass burn, or other thermal gasification technology) is in the near term unlikely. Furthermore, the University's existing boilers represent a useful life to the year 2040, at which time another technology may become feasible for consideration.

13.1.2.3 Anaerobic Digestion Potential

SCS initiated discussions with UNC staff to see if future collaboration opportunities would make sense for the Town. UNC staff confirmed UNC's desire to end its use of coal on campus and to move to renewable energy supplies. The current effort to burn LFG is one move in that direction. UNC is interested in looking at the feasibility of anaerobic digestion to process the university's food waste and biomass requiring disposal. They recognize a significant advantage of anaerobic digestion in reducing greenhouse gas emissions from the coal-fired boilers as well as providing renewable energy supplies.

Food waste is currently collected by Orange County at four campus locations (e.g., dining facilities) and hauled off campus to Brooks Contracting where it is composted in windrow piles. This existing operation is a key development towards a successful digester project in that source separation of organics and food waste is presently occurring and these operations do not need development. Furthermore, with the proven operations of firing LFG in the campus boilers, biogas generated by an anaerobic digestion operation may simply be fed into and blended with LFG in the existing pipeline, thereby reducing the need for a separate conversion unit associated with the anaerobic digestion unit. However, SCS's discussions with UNC staff recognized that siting an anaerobic digester operation at the landfill, near the campus power plant, or elsewhere on campus would likely present challenges. SCS recognizes that the development of the new Carolina North campus and construction of a second power plant to support this campus while utilizing the LFG presents a unique collaborative opportunity to include anaerobic digestion in the design of this infrastructure and its utilities.

UNC staff has noted that a few other academic communities have successfully implemented (or are evaluating) anaerobic digestion systems to manage their food wastes, and thus supporting sustainable, green campus operations to include: the University of Wisconsin and Michigan State University. Therefore, the interest in developing this technology is high. University staff believes other neighboring communities could partner on such a project. While implementing an anaerobic digester project to manage campus and Town organic and food waste would impact the current aerobic composting operations, UNC staff also recognize the addition of many other sustainable benefits including greenhouse gas (GHG) reductions, generating RECs and carbon offset credits, and promoting safety by eliminating long hauling.

13.1.3 North Carolina State University

NCSU houses a department of Waste Reduction and Recycling (WRR) which is also the name of one of the eight key focus areas for the Campus Environmental Sustainability Team (CEST). The goal of WRR is to divert university waste from the landfill through education, efficient processes and operational endeavors. Since establishing the office in 2001, NC State has seen WRR's efforts make tremendous improvements to the campus solid waste management program. As of 2010, the University has reportedly achieved a 45.45% diversion rate. The University has set a goal of 65% diversion rate by 2015, as outlined in the Sustainability Strategic Plan.

NCSU has a had a long history of solid waste recycling going back to 1975 when the University began hand sorting of campus recyclables. A campus-wide curbside recycling program was

initiated in 1988, which involved a residence hall pilot program beginning in 1990 and yard waste recycling a few years after that. Currently, NCSU's organic materials (i.e., dining hall food waste, animal bedding, yard waste, etc.) are collected and composted by Brooks Contracting like UNC.

In January, 2011, NCSU broke ground on a $61 million performance contract with Ameresco, Inc., part of which will install an 11 Megawatt (MW) Combined Heat and Power (CHP) system in Cates Utility Plant. The CHP system, also called cogeneration, will pay for itself through energy savings over 17 years. The upgrade at Cates Utility Plant is expected to be completed in summer 2012.

Initial discussions with NCSU's Sustainability Director, Ms. Tracy Dixon, suggested that NCSU would be interested in partnering with the Town to consider and solicit applicable research grant and educational funding to initiate feasibility studies to involve the development of a WTE or WC technology (e.g., anaerobic digestion) in the region.

13.2 OTHER AVAILABLE AREA RESOURCES, PROJECTS, AND FUNDING

13.2.1 Environmental Research and Education Foundation

The Environmental Research and Education Foundation (EREF) is located in Raleigh, North Carolina. The purpose of EREF is to fund and direct scientific research and educational initiatives for waste management practices to benefit industry participants and the communities they serve. Discussions with Mr. Bryan Staley, President, indicated that EREF is currently completing an in-house study on various aspects of WTE and WC technologies. Mr. Staley indicated that he would entertain future opportunities to collaborate with the Town on feasibility aspects. Importantly, EREF has an ongoing grant program to conduct research studies, usually in collaboration with university researchers.

Researchers are invited to submit proposals on solid waste management issues contained in EREF's Strategic Research Plan or on educational projects. EREF routinely assesses research needs within the solid waste field via the EREF's Council, a committee comprised of industry stakeholders and academia. General and/or targeted requests for proposals (RFPs) are generated at the request of the Council by EREF staff and posted on EREF's website (www.erefdn.org) and advertised in other media. Other unsolicited proposals (e.g., educational projects) are equally welcome for EREF consideration. Descriptions of ongoing and previously completed grants and projects may also be found on EREF's website. Previously awarded grants have ranged from $15,000 to over $500,000 with the average grant amount being $100,000.

Submissions of scientific research proposals related to sustainable solid waste management practices are invited in the following areas:

- Waste minimization.
- Recycling.

- Waste conversion to energy, biofuels, chemicals or other useful products. This includes, but is not limited to, the following technologies:

  - Waste-to-energy
  - Pyrolysis/Gasification
  - Oxidation
  - Anaerobic digestion
  - Composting

- Strategies to promote diversion from landfills (e.g., separating organics, market analysis, optimized material management, logistics, etc.).

There are two annual deadlines for solicited proposal submissions: January 5 and July 15 of each year. Similarly, the two annual deadlines for unsolicited proposal submissions are: October 1 and May 21 of each year.[24]

The Town should consider collaborating with one of the area universities, specifically targeting an anaerobic digestion feasibility study or pilot project and/or organics diversion project.

13.2.2 Southern Research Institute

The Southern Research Institute has developed a small scale (i.e., 2 tons per day) MSW gasification plant in operation in nearby Durham, North Carolina. This facility is a pilot demonstration plant, which is being funded under several grants. The throughput capacity and purpose for this facility will not support a contribution of MSW feedstock from the Town. However, SCS recommends that Town staff and Council coordinate a tour of this operation to evaluate potential facility siting issues regarding alternative WC technologies and processes.

13.2.3 North Carolina Biofuels Center

The long-term task of the Biofuels Center of North Carolina (Center) is to develop a statewide biofuels industry sector to reduce the state's dependence on imported petroleum. The Center's mandate to do so is from the North Carolina General Assembly and the framework for doing so is provided by North Carolina's Strategic Plan for Biofuels Leadership. To achieve the goal of having 10% of North Carolina's liquid fuels grown, produced, and sold in-state within 10 years, the Biofuels Center of North Carolina has awarded funds to academic institutions, economic development organizations, nonprofit corporations and other entities across the state through a competitive awards process. Biofuels Center grants and contracts are designed to identify and bridge gaps in knowledge and information, speed the development of technology to industry, and create a seamless continuum from agriculture to transportation fuels.[25]

The Center has an annual competitive grants program. In fiscal year 2011-2012, the Biofuels Center of North Carolina awarded $1,479,949 through its grants program. The program awards grants to nonprofit organizations and academic institutions across the state to help develop the biofuels sector. Current funding for the 2011 and 2012 application period is closed; however,

24 www.erefdn.org/index.php/grants/proposal
25 www.biofuelscenter.org/index.php/grants

the Town could collaborate with an area university to prepare and apply for a grant pending in 2013. SCS's review of past awards described on the Center's website (www.biofuelscenter.org) suggests that grant funds may be applied for the study of converting MSW into biofuel. An example project may include anaerobic digestion of MSW and delivering biogas to supplement the LFG collected from the Orange County Landfill and being combusted by UNC Chapel Hill.

13.2.4 USDA Rural Energy for America Program

The Rural Energy for America Program (REAP) provides assistance to agricultural producers and rural small businesses to complete a variety of projects. Offering both loan guarantees and grants, the REAP program helps eligible applicants install renewable energy systems such as anaerobic digesters or solar panels, and to conduct feasibility studies researching these systems. Based on the program guidelines, the Town is likely not directly eligible as the program targets agricultural producers directly engaged in the production of agricultural products (i.e., crops, livestock, forestry products, hydroponics, nursery, and aquaculture) whereby 50% + or greater of their gross income is derived from the operations. However, strategic collaboration with such identified small businesses, along with the neighboring universities' educational research resources, to utilize the Town's waste to contribute to a renewable energy project would present an eligible project.

The maximum amount of a REAP Guaranteed Loan is $25 million per loan request. The minimum loan amount is $5,000. Up to 75% of total eligible project costs can be covered through the REAP Guaranteed Loan Program. The minimum Renewable Energy System Grant request is $2,500 up to a maximum of 25% of eligible project costs or $500,000, whichever is less. More information on these USDA programs may be found on their website (www.rurdev.usda.gov/BCP_Reap).

13.3 RECOMMENDATIONS FOR FURTHER COLLABORATION EFFORTS

Based on our initial discussions with potential WC feasibility partners in the vicinity of the town, SCS recommends that more, in-depth discussions take place with UNC to collaborate on an anaerobic digestion project to manage the University and Town-generated organic waste. Firm support for successful collaboration on such a project is demonstrated by:

- The University appears to have a firm desire to become more "carbon neutral" by employing more sustainable technologies to solve its solid waste management issues, while, at the same time, provide more renewable energy supplies to replace coal. Similarly, the Town's newly adopted Comprehensive Plan outlines goals for reducing community greenhouse gas emissions.

- Boiler modifications have been completed to co-fire biogas and coal, and gas transmission pipeline infrastructure has been constructed.

- Source segregation of food waste has already been successfully demonstrated by UNC, presenting a ready feedstock for a pilot project without encumbering additional cost.

- UNC operates successful yard waste processing and paper recycling operations on campus which would further provide feedstock.

- The Town generates a comparable volume of yard waste to contribute to the process and can represent significant further gains in organic waste segregation from its general population.

- Many universities, such as the University of Wisconsin and Michigan State University, are moving ahead with anaerobic digestion projects for their organic materials.

To gain a more firm understanding of the technical and economic requirements to support such a project, SCS recommends that the Town and UNC secure grant funding for an engineering feasibility study for this project. SCS is aware of available funding through the North Carolina Biofuels Center for the upcoming budget year. Exhibit 13-1 lists a contact summary for collaboration efforts.

Exhibit 13-1. Collaboration Contact Summary

Institution/Organization	Contact Name	Title/Role	Contact Info
University of North Carolina at Chapel Hill	Ms. B. J. Tipton	Solid Waste Program Manager	(919) 962-7251 btipton@fac.unc.edu
	Mr. Eric Ripley	Greenhouse Gas Specialist Energy Services Dept.	(919) 843-7572 Eric.ripley@energy.unc.edu
	Mr. Ray Dubuse	Director Energy Services Dept.	(919) 966-4100 Ray.DuBose@energy.unc.edu
	Mr. Phil Barner	Assistant Director Energy Services Dept.	(919) 843-8305 Philip.Barner@energy.unc.edu
North Carolina State University	Ms. Tracey Dixon	University Sustainability Director	(919) 513-0211 tadixon@ncsu.edu
	Mr. Mort Barlaz	Dept. of Civil Engineering	(919) 515-7676 barlaz@unity.ncsu.edu www4.ncsu.edu/~barlaz
	Mr. Jack Colby	Asst. Vice Chancellor for Facilities Operation	(919) 515-2967 Jack_colby@ncsu.edu
Duke University	Ms. Tavey McDaniel	Sustainability Director	(919) 660-1434 tavey.mcdaniel@duke.edu
Environmental Research and Education Foundation	Mr. Brian Staley	President	(919) 861-6876 bstaley@erefdn.org www.erefdn.org
Southern Research Institute	Mr. Tim Hansen	Director	(919) 282-1050 (919) 282-1052 hansen@southernresearch.org www.southernresearch.org
Biofuels Center of North Carolina			(919) 693-3000 www.biofuelscenter.org www.ncbiofuels.net

14.0 PRO FORMA EVALUATION

14.1 PURPOSE OF PRO FORMA

SCS developed a Pro Forma Model specifically for this Study to provide preliminary, planning-level cost estimates and revenue projections to compare the alternative collection, disposal, recycling, and other solid waste program scenarios considered for the Town during the course of this Study. This section presents the structure, details, and sample results of the Pro Forma Model and economic analyses. Full printouts of the pro forma model can be supplied to the Town; however, due to the size of the pro forma output printouts and number of scenarios considered in the analysis, this report only provides the summary tables for presentation purposes. A 30-year planning period was selected to estimate the net present values of the alternative scenarios considered.

The Pro Forma Model is a spreadsheet program that projects annual costs to construct, operate, administer, and maintain the Town's existing and hypothetical future solid waste collection, processing, recycling, and disposal infrastructure. The model uses decision tree-type logic to modify waste projections, collection and disposal costs and revenues estimates, select disposal location (e.g., direct haul to an existing transfer station, construct a new transfer station, or direct haul to a new or existing landfill), and schedule when certain program modifications are implemented. The model addresses major capital and an operational cost to operate the Town's solid waste system under various assumptions and configurations as described in more detail below.

The model is fairly complex. Various assumptions are made regarding annual solid waste quantities, population projections, escalation rates for waste growth and costs, administration costs, transportation costs, and landfill, waste-to-energy, and conversion technology processing and disposal costs. The output from the model is an estimate of the net present value (NPV) of each alternative strategy or scenario. NPV costs are calculated for each alternative scenario for the 30-year planning period to allow for comparison of the scenarios from a cost perspective. NPV is the current value of one or more future cash payments and offsetting revenues discounted at an assumed interest rate. A NPV analysis is a useful tool in evaluating alternatives involving complex cash flows. For this analysis, a lower NPV represents a more favorable scenario from an overall cost perspective.

14.2 MAJOR COMPONENTS OF PRO FORMA MODEL

The structure and major assumptions of the Pro Forma Model are summarized below:

- **Model Structure.** The Pro Forma Model is an excel spreadsheet that performs various decision tree, cost allocation, and forecasting functions.

- **Waste Generation Estimates**. As presented in Exhibit 14-1, waste generation estimates were prepared based on historical data from the Town, including MSW quantities collected from residential and commercial customers, and the quantities of vegetative waste (i.e., yard waste), and bulky waste.

- The waste generation scenarios modeled include the base case (status quo), and implementing PAYT and/or an organics diversion programs (see Sections 7 and Section 3, respectively). The scenarios demonstrate the theoretical decrease in quantity of waste requiring transferring and landfilling if PAYT or organics diversion programs are implemented.

- The waste generation and disposal quantities are escalated based on the projected growth rates of 1.62% (projected average growth rate between now and 2035, see Section 2.1.4). The projections associated with the baseline, PAYT, and organics diversion scenarios are presented in Exhibit 14-1, Exhibit 14-2, and Exhibit 14-3 for fiscal years 2013 through 2022 (first 10 years) for illustrative purposes. These estimates are input into other program elements in the Pro Forma Model depending on the program scenario selected.

- For the organics diversion scenario, the assumption is made that the commercial sector would also participate in the program. Achieving these reductions would require substantial changes in the collection system, significant public education, and development of a new facility or contract with an existing organics processing facility as part of implementation.

- **Town Budget**. The Town's draft FY 2012-13 budget was initially used to structure the pro forma model. The model inputs have updated to reflect the final approved budget. However, there are some minor variances in the pro forma model compared to the approved budget (about a $3000 variance) due to the assumed solid waste disposal quantities and rounding. As a comparison, the pro forma budget used in SCS's analysis shows a total budget of $2.97 million compared to $2.98 million in the approved budget.

  - The budgets include the operational budget and capital expenditure budgets proposed for FY 2012-13. The pro forma budget for FY 2012-13 is presented in Exhibit 14-4. The Town's budget was used to establish baseline functional costs for collection and disposal services provided by the Town.

  - The Town budget as reflected in the Pro Forma Model also includes additional line item costs that address budget impacts from implementing potential new programs considered as a part of this Study (e.g., constructing a new transfer station, materials recovery facility, or organics processing facility, implementing a PAYT program, direct hauling to an existing transfer station or landfill, or modifying commercial collection practices). The Town's budget is based on funding for six residential collection routes. Additional discussions of the Town's residential and commercial collection system and options are provided in Sections 2, 4, and 5.

Exhibit 14-1. Solid Waste Projections, Town of Chapel Hill
Status Quo Scenario, FY 2012 - 2022

Waste Type	2012 6/30/2012	2013 6/30/2013	2014 6/30/2014	2015 6/30/2015	2016 6/30/2016	2017 6/30/2017	2018 6/30/2018	2019 6/30/2019	2020 6/30/2020	2021 6/30/2021	2022 6/30/2022
Total Solid Waste Collected By Town	**18,220**	**18,510**	**18,830**	**19,120**	**19,420**	**19,750**	**20,080**	**20,400**	**20,720**	**21,070**	**21,410**
Residential-MSW	6,670	6,780	6,890	7,000	7,110	7,230	7,350	7,470	7,580	7,710	7,840
Commercial-MSW	**8,460**	**8,590**	**8,740**	**8,880**	**9,020**	**9,170**	**9,320**	**9,470**	**9,630**	**9,780**	**9,940**
Commercial-Residential	4,500	4,570	4,650	4,720	4,800	4,880	4,960	5,040	5,120	5,200	5,290
Commercial-Business	3,960	4,020	4,090	4,160	4,220	4,290	4,360	4,430	4,510	4,580	4,650
Bulky Waste	170	170	180	180	180	180	190	190	190	200	200
Veg Waste	2,920	2,970	3,020	3,060	3,110	3,170	3,220	3,270	3,320	3,380	3,430
PAYT Changes											
Residential MSW (inlcuding bulky waste, total reduction)		-	-	-	-	-	-	-	-	-	-
Yard Waste		-	-	-	-	-	-	-	-	-	-
Recycling		-	-	-	-	-	-	-	-	-	-
Reduction		-	-	-	-	-	-	-	-	-	-
Organics Diversion		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Residential		-	-	-	-	-	-	-	-	-	-
Commercial		-	-	-	-	-	-	-	-	-	-
Total Solid Waste/Recycling	**20,890**	**21,220**	**21,590**	**21,920**	**22,270**	**22,640**	**23,020**	**23,390**	**23,760**	**24,160**	**24,550**
Landfilled	**15,300**	**15,540**	**15,810**	**16,060**	**16,310**	**16,580**	**16,860**	**17,130**	**17,400**	**17,690**	**17,980**
Residential	6,840	6,950	7,070	7,180	7,290	7,410	7,540	7,660	7,770	7,910	8,040
Commercial	8,460	8,590	8,740	8,880	9,020	9,170	9,320	9,470	9,630	9,780	9,940
Veg Waste	2,920	2,970	3,020	3,060	3,110	3,170	3,220	3,270	3,320	3,380	3,430
Curbside Recycling	2,670	2,710	2,760	2,800	2,850	2,890	2,940	2,990	3,040	3,090	3,140

1. All values are in units of tons.

Exhibit 14-2. Solid Waste Projections, Town of Chapel Hill Implement PAYT Program, FY 2012 - 2022

Waste Type	2012 6/30/2012	2013 6/30/2013	2014 6/30/2014	2015 6/30/2015	2016 6/30/2016	2017 6/30/2017	2018 6/30/2018	2019 6/30/2019	2020 6/30/2020	2021 6/30/2021	2022 6/30/2022
Total Solid Waste Collected By Town	**18,220**	**18,510**	**18,040**	**18,310**	**18,610**	**18,920**	**19,230**	**19,550**	**19,850**	**20,180**	**20,510**
Residential-MSW	6,670	6,780	5,720	5,800	5,910	6,000	6,090	6,210	6,290	6,390	6,510
Commercial-MSW	**8,460**	**8,590**	**8,740**	**8,880**	**9,020**	**9,170**	**9,320**	**9,470**	**9,630**	**9,780**	**9,940**
Commercial-Residential	4,500	4,570	4,650	4,720	4,800	4,880	4,960	5,040	5,120	5,200	5,290
Commercial-Business	3,960	4,020	4,090	4,160	4,220	4,290	4,360	4,430	4,510	4,580	4,650
Bulky Waste	170	170	180	180	180	180	190	190	190	200	200
Veg Waste	2,920	2,970	3,400	3,450	3,500	3,570	3,630	3,680	3,740	3,810	3,860
PAYT Changes											
Residential MSW (inlcuding bulky waste, total reduction)		-	(1,170)	(1,200)	(1,200)	(1,230)	(1,260)	(1,260)	(1,290)	(1,320)	(1,330)
Yard Waste		-	380	390	390	400	410	410	420	430	430
Recycling		-	380	390	390	400	410	410	420	430	430
Reduction		-	(410)	(420)	(420)	(430)	(440)	(440)	(450)	(460)	(470)
Organics Diversion		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Residential		-	-	-	-	-	-	-	-	-	-
Commercial		-	-	-	-	-	-	-	-	-	-
Total Solid Waste/Recycling	**20,890**	**21,220**	**20,010**	**20,300**	**20,650**	**20,980**	**21,320**	**21,690**	**22,020**	**22,380**	**22,750**
Landfilled	**15,300**	**15,540**	**13,470**	**13,660**	**13,910**	**14,120**	**14,340**	**14,610**	**14,820**	**15,050**	**15,320**
Residential	6,840	6,950	5,900	5,980	6,090	6,180	6,280	6,400	6,480	6,590	6,710
Commercial	8,460	8,590	8,740	8,880	9,020	9,170	9,320	9,470	9,630	9,780	9,940
Veg Waste	2,920	2,970	3,400	3,450	3,500	3,570	3,630	3,680	3,740	3,810	3,860
Curbside Recycling	2,670	2,710	3,140	3,190	3,240	3,290	3,350	3,400	3,460	3,520	3,570

1. All values are in units of tons.

Exhibit 14-3. Solid Waste Projections, Town of Chapel Hill
Implement Organics Diversion and PAYT Program, FY 2012 - 2022

Waste Type	2012 6/30/2012	2013 6/30/2013	2014 6/30/2014	2015 6/30/2015	2016 6/30/2016	2017 6/30/2017	2018 6/30/2018	2019 6/30/2019	2020 6/30/2020	2021 6/30/2021	2022 6/30/2022
Total Solid Waste Collected By Town	**18,220**	**18,510**	**18,040**	**18,310**	**18,610**	**18,920**	**19,230**	**19,550**	**19,850**	**20,180**	**20,510**
Residential-MSW	6,670	6,780	5,720	5,800	5,910	6,000	6,090	6,210	6,290	6,390	6,510
Commercial-MSW	**8,460**	**8,590**	**8,740**	**8,880**	**9,020**	**9,170**	**9,320**	**9,470**	**9,630**	**9,780**	**9,940**
Commercial-Residential	4,500	4,570	4,650	4,720	4,800	4,880	4,960	5,040	5,120	5,200	5,290
Commercial-Business	3,960	4,020	4,090	4,160	4,220	4,290	4,360	4,430	4,510	4,580	4,650
Bulky Waste	170	170	180	180	180	180	190	190	190	200	200
Veg Waste	2,920	2,970	3,400	3,450	3,500	3,570	3,630	3,680	3,740	3,810	3,860
PAYT Changes											
Residential MSW (inlcuding bulky waste, total reduction)		-	(1,170)	(1,200)	(1,200)	(1,230)	(1,260)	(1,260)	(1,290)	(1,320)	(1,330)
Yard Waste		-	380	390	390	400	410	410	420	430	430
Recycling		-	380	390	390	400	410	410	420	430	430
Reduction		-	(410)	(420)	(420)	(430)	(440)	(440)	(450)	(460)	(470)
Organics Diversion		**-**	**1,240**	**1,260**	**1,280**	**1,300**	**1,320**	**1,340**	**1,370**	**1,390**	**1,410**
Residential		-	1,240	1,260	1,280	1,300	1,320	1,340	1,370	1,390	1,410
Commercial		-	-	-	-	-	-	-	-	-	-
Total Solid Waste/Recycling	**20,890**	**21,220**	**20,010**	**20,300**	**20,650**	**20,980**	**21,320**	**21,690**	**22,020**	**22,380**	**22,750**
Landfilled	**15,300**	**15,540**	**12,230**	**12,400**	**12,630**	**12,820**	**13,020**	**13,270**	**13,450**	**13,660**	**13,910**
Residential	6,840	6,950	4,660	4,720	4,810	4,880	4,960	5,060	5,110	5,200	5,300
Commercial	8,460	8,590	8,740	8,880	9,020	9,170	9,320	9,470	9,630	9,780	9,940
Veg Waste	2,920	2,970	3,400	3,450	3,500	3,570	3,630	3,680	3,740	3,810	3,860
Curbside Recycling	2,670	2,710	3,140	3,190	3,240	3,290	3,350	3,400	3,460	3,520	3,570

1. All values are in units of tons.

Exhibit 14-4. Pro Forma Budget Summary for FY 2012-13

Scenario: A, New route, City of Durham TS, No Automate Residential Scenario A Annual Budget	Total ($) 2013
Item	6/30/2013
TOWN SOLID WASTE BUDGET	
Collection Personnel Services	
Salaries - Full-Time	**1,632,400**
Other Pay	1,900
Salaries - Temporary	-
Workers Comp Insurance	51,800
Additional Labor From Direct Haul	-
Subtotal, Collection Personnel Services	**1,686,100**

Collection Scenario Allocation Percentages By Function	FY 2013
Residential	A
Commercial	A
Cost Allocation %	
Tonnage	
Residential	44.7%
Commercial	55.3%
Commercial-Residential (multi-family)	29.4%
Commercial-Business	25.9%
Staff #	
Residential	80.8%
Commercial	19.2%
Commercial-Residential (multi-family)	10.2%
Commercial-Business	9.0%
Truck Fuel & OM Costs	
Residential	87%
Commercial	13%
Commercial-Residential (multi-family)	0%
Commercial-Business	13%
Miscellaneous Contract Services	
Residential	22%
Commercial	78%
Commercial-Residential (multi-family)	39%
Commercial-Business	39%

Notes:

1. Residential Scenario "A" is status quo.
2. Commercial Scenario "A" is status quo.
3. Percentages may vary by year depending on scenarios being evaluated

Annual Budget	Total ($) 2013
Item	6/30/2013
Collection Operating Expenses	
Professional Services	500
Personnel Agency Payments	9,000
Business Meetings & Training	4,600
Career Development Training	1,100
Dues & Subscriptions	-
Pagers	-
Cellular Phones	-
Advertising	2,500
Personnel Advertising	-
Equipment Rentals	-
Uniform Rentals	12,500
Landfill Fines	2,500
Charges by Landfill	**939,300**
MSW	885,800
Yard Waste	53,500
Fleet Use Charges	**200,400**
Fleet Use Charges	200,400
Additional Fleet Use Charges for Direct Haul	-
Vehicle Replacement Charges	**310,600**
County Budgeted Vehicle Replacement Charge	310,600
New Vehicle for new route	-
Automatic carts, 95 gallon	-
Misc. Contracted Services	22,000
Supplies	49,000
Fuel	**121,200**
Vehicle Fuel	121,200
Additional Fuel Charge for Direct Haul	-
Subtotal, Operation Expenses	**1,675,200**

Annual Budget	Total ($) 2013
Item	6/30/2013
NEW PROGRAM ALTERNATIVES	**-**
	-
PAYT	**-**
Transfer Station & Hauling	**-**
Transfer Station	-
Hauling Operations	-
Yard Waste Processing Facility	-
New Landfill (Included in Charges by Landfill above)	-
Organics Diversion	**-**
Collection	-
Disposal	-
Subtotal, New Program Alternatives	**-**
TOTAL BUDGET, COLLECTION AND DISPOSAL	**3,361,300**
Capital Outlay	
Collection Vehicles	20,000
Transfer Station	**-**
Transfer Station	-
Transfer Hauling Equipmeent	-
New Landfill (Included as Tip Fee Above under disposal)	**-**
Landfill Equipment	-
Landfill Construction	-
Vegetative Waste Processing Facility	-
Organics Processing Facility (private: not owned by Town)	-
New Automated Collection Carts	-
PAYT - Trash Cans	-
Subtotal Capital Outlay	**20,000**
REVENUE	-
Garbage Collection Revenue (Commercial front load service)	312,000
Special Trash Collection (bulky, white goods, yard waste, etc.)	8,000
Compactor Fees (2 downtown compactors)	40,000
Garbage Citations (Commercial and residential)	3,000
Sales: Yard Waste Carts	3,000
Solid Waste Disposal Tax	21,000
Total, Revenue, $	**387,000**
	-
Net Costs (not including Capital Outlay) - Revenue	**2,974,300**

- **Cost Allocation by Function**. The Town's budget is allocated between residential and commercial collection services. The color highlighted areas in Exhibit 14-4 show the groupings used by the Town to allocate costs to commercial or residential functions either by personnel count, equipment count or some other basis. SCS reviewed the allocation methodology used by the Town. The allocation methodology appears reasonable. We made some slight modifications associated with maintenance costs. The current methodology allocates these costs between residential and commercial services as a function of the number of trucks assigned to each service. We used the actual historical O&M cost data provided by the Town for each vehicle to allocate the O&M costs. The Town provided guidance on the assignment of personnel to residential or commercial functions. A summary of the allocation percentages between residential and commercial services is provided in Exhibit 14-4.

- **Fleet Usage, Fuel Costs (Operation and Maintenance), and Equipment Capital Cost.** The Town maintains records on the maintenance costs for the solid waste collection vehicles, including fuel, maintenance and mileage statistics on a year-to-date and cumulative basis. As fuel prices fluctuate and for this analysis, a rate of $2.91 per gallon for diesel fuel was used. The Town's records also include the date of purchase and the purchase value for the collection equipment. SCS assumed that vehicles would be replaced on a 7-year cycle, and those costs amortized over a 7-year period. No salvage value was assigned to equipment as a part of this economic analysis. Including salvage value would reduce estimated capital expenditures and amortized costs; therefore, the capital expenditure and amortized cost projections provided herein are conservative.

- **Capital Costs.** The Pro Forma Model keeps track of the major capital expenditures associated with the various program scenarios evaluated. The amortized expenses for the various capital expenditures are included in the budget based on an interest rate of 4% (a variable which can be adjusted). The amortization period varies depending on the asset. For heavy equipment, a 7 year amortization period is assumed in most cases. For large facility expenses such as development of a transfer station or new landfill, 20 to 30 year amortization periods are selected.

- **Revenue**. The Town receives revenue from various sources as shown in Exhibit 14-6. The largest revenue source is fees from commercial collection services. A more detailed discussion on revenue sources is provided in Section 2.3. In addition, an evaluation of the commercial collection services, rates, and the changes in revenue that could occur if commercial services were modified or eliminated is presented in Appendix A.

Market Assumptions for Alternative Disposal Facilities. SCS conducted a survey of available transfer stations and landfills within a 200-mile radius of the Town. The reported tip fees (see Section 2.2) ranged from $28 to $60 per ton. We understand that the reported market tip fees may vary for a given site depending on the owner of the facility, its relationship with those using the facility, the quantity of waste being disposed, and market conditions at any given time. However, the tip fees seem consistent with current market conditions encountered by SCS in the region. The

reported tip fees and estimated travel distances to these facilities were used to calculate total disposal costs and transfer costs for the alternative disposal facilities in close proximity to the Town (see Section 2.2, Section 6, and Section 10).

- **Escalation Rate.** SCS assumed a 3% inflation rate for projecting future costs. Over the last 22 years, the change in the Consumer Price Index, as reported by the Bureau of Labor and Statistics, has ranged from -0.4% (2009) to 4.2% (1990), with an average of 2.6% and median of 2.8%. A 3% escalation is within the range of historical inflation rates (Bureau of Labor and Statistics, U.S. Consumer Price Index Tables 1912-2011).

- **Interest and Discount Rates**

  - Borrow/Financing Rate: 4%

  - Discount Rate: 5%. The discount rate is used to estimate the net present value of the Town's potential future solid waste scenarios in order to compare alternatives with varying yearly expenditures.

- **Dollar Basis.** Calendar Year 2012

14.3 PROGRAM COST MODULES

The following program cost modules were developed and incorporated into the Pro Forma Model (see referenced sections below for more detailed information on specific technologies and facilities evaluated):

- Disposal

  - Direct Haul to Transfer Station (see Section 6)
  - Direct Haul to Landfill (see Section 10)
  - New Transfer Station (Town-only or Regional) (see Section 7)
  - New Material Recovery Facility (see Section 9, not included in pro forma summary options)
  - Landfill (Town-only or Regional) (see Section 11)
  - Organics Management (see Section 4)
  - Yard Waste Management
  - Waste-to-Energy (evaluated but not included in cost model due to high cost and other impediments to practical implementation)

- Collection

  - Status quo
  - Automated collection
  - Additional requirements for direct hauling to landfill or transfer station
  - Commercial collection options: Status Quo, keep multi-family collection, eliminate commercial collection.

- PAYT
- Organics diversion and conversion technologies

Capital, operation and maintenance costs were estimated for various program scenarios considered. In addition, fuel consumption was also calculated for the transfer alternatives to provide a comparison of the consumption on non-renewable fossil fuel resources. Tip fees were estimated for Town-only facilities and market conditions assumed for other transfer and landfill facilities. A net annual cost and NPV calculation was estimated for each program scenario over a 30-year period, and the results compared.

14.4 PRO FORMA RESULTS

The pro forma cost analysis results are included and discussed in the report sections as applicable. The Pro Forma Model allows for the assessment of the Town's projected budgetary costs as a function of various program decisions, and through NPV calculations, the ability to compare the financial implications of complex program decisions over an extended period (e.g., 30 years). An example listing of "Program Scenarios" and program decision inputs into the Pro Forma Model is provided in Exhibit 14-5.

The Pro Forma Model considers each of these program decisions inputs, calculates staffing changes and costs, equipment changes and costs, inputs new program or facility costs as appropriate (e.g., direct haul to a landfill or transfer station, construction of a new transfer station, implementing a PAYT program), accounts for whether solid waste will be disposed at an existing transfer station or another private or municipal landfill, and schedules these changes based on assumptions regarding the year a given change will be implemented (e.g., when a new transfer station would be constructed, if a regional landfill was constructed, when it might be available). The Pro Forma Model automatically varies the potential disposal locations and adjusts costs accordingly (see Sections 6, 7, 10, and 11).

Example outputs of the Pro Forma Model and the NPV summary calculations are provided in Exhibit 14-6 and Exhibit 14-7, respectively. From the summary NPV table, general conclusions can be inferred as to what course of action might be the most cost-effective. In this example, the following conclusions could be considered based on a review of the summary NPV calculations for the scenarios evaluated:

- Direct Hauling to either the City of Durham Transfer Station or Austin Quarter SW Management Facility (Alamance County) appears to be the most cost-effective short-term disposal options. Direct hauling to the Waste Industries transfer station in Durham or to the South Wake Landfill are other options that yield similarly cost-effective results. However, both the Wake County and Alamance County landfills are currently designated exclusively for waste generated within those counties only.

Exhibit 14-5. Example Program Scenarios and Decision Inputs

Program Choices	Live Input	Program Choices Scenarios								
	A	A	B	C	D	E	F	G	H	I
Inputs to Assumptions Worksheet										
Commercial Collection										
Keep Commercial-Business (Yes/No?)	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Keep Multi-Family Collection (Yes/No?)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Year if Privatize Commercial	2014	2014	2014	2014	2014	2014	2014	2014	2014	2014
Automation										
Begin Phase I Purchase of Automation, (Yes/No?)	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Begin Phase I Purchase of Automation, Year	2014	2014	2014	2014	2014	2014	2014	2014	2014	2014
Begin Phase II Automation (Yes/No?)	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Begin Phase II Automation Year	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015
PAYT										
PAYT Program? (Yes/No?)	No	No	No	No	No	Yes	No	Yes	No	Yes
PAYT MSW Reduction, %	0.17	17%	17%	17%	17%	17%	17%	17%	17%	17%
Fiscal Year to Implement PAYT	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015
Organics Diversion										
Organics Diversion Program? (Yes/No?)	No	No	No	No	No	No	Yes	Yes	No	Yes
Organics Diversion Program Begin, Year	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015
New Landfill										
New Landfill, Town Only	No	No	No	No	No	No	No	No	No	No
New Landfill, Regional	No	No	No	No	No	No	No	No	Yes	Yes
Year to Construct	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018
Year to Operate	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019
Residential Collection Days										
3-Day Per Week Residential	Yes									
2-Day Per Week Residential	No									

Note: The Program Scenario designations of "A"-"I" are used as placeholders/markers in the pro forma model and represent distinct groupings of major system assumptions that affect a given program scenario.

Exhibit 14-6. Example Pro Forma Output FY 2013 - 2022

Scenario: A, New route, City of Durham TS, No Automate Residential
Scenario A

Full Costs

Annual Budget

Item	2013 6/30/2013	2014 6/30/2014	2015 6/30/2015	2016 6/30/2016	2017 6/30/2017	2018 6/30/2018	2019 6/30/2019	2020 6/30/2020	2021 6/30/2021	2022 6/30/2022
TOWN SOLID WASTE BUDGET										
Collection Personnel Services										
Salaries - Full-Time (Includes Benefits)	**1,632,400**	**1,681,400**	**1,731,800**	**1,783,800**	**1,837,300**	**1,892,400**	**1,949,200**	**2,007,600**	**2,067,900**	**2,129,900**
Other Pay	1,900	2,000	2,000	2,100	2,200	2,200	2,300	2,400	2,400	2,500
Workers Comp Insurance	51,800	53,300	54,900	56,600	58,300	60,000	61,800	63,700	65,600	67,500
Additional Labor From Direct Haul	-	-	-	-	-	-	-	-	-	-
Subtotal, Collection Personnel Services	**1,686,100**	**1,736,700**	**1,788,700**	**1,842,500**	**1,897,800**	**1,954,600**	**2,013,300**	**2,073,700**	**2,135,900**	**2,199,900**
Collection Operating Expenses										
Professional Services	500	500	500	500	600	600	600	600	600	700
Personnel Agency Payments	9,000	9,300	9,500	9,800	10,100	10,400	10,700	11,100	11,400	11,700
Business Meetings & Training	4,600	4,700	4,900	5,000	5,200	5,300	5,500	5,700	5,800	6,000
Career Development Training	1,100	1,100	1,100	1,100	1,200	1,200	1,300	1,300	1,300	1,400
Advertising	2,500	2,600	2,700	2,700	2,800	2,900	3,000	3,100	3,200	3,300
Uniform Rentals	12,500	12,900	13,300	13,700	14,100	14,500	14,900	15,400	15,800	16,300
Landfill Fines	2,500	2,600	2,700	2,700	2,800	2,900	3,000	3,100	3,200	3,300
Charges by Landfill	**939,300**	**748,100**	**782,500**	**818,700**	**857,400**	**898,000**	**939,600**	**982,900**	**1,029,500**	**1,077,600**
MSW	885,800	692,200	724,100	757,400	793,000	830,700	869,300	909,500	952,400	997,000
Yard Waste	53,500	55,900	58,400	61,300	64,400	67,300	70,300	73,400	77,100	80,600
Fleet Use Charges	**200,400**	**300,100**	**309,300**	**318,400**	**328,200**	**338,000**	**348,200**	**358,400**	**369,800**	**380,600**
Vehicle Replacement Charges	**310,600**	**310,600**	**310,600**	**310,600**	**310,600**	**310,600**	**310,600**	**310,600**	**310,600**	**310,600**
County Budgeted Vehicle Replacement Charge	310,600	310,600	310,600	310,600	310,600	310,600	310,600	310,600	310,600	310,600
New Vehicle for new route	-	-	-	-	-	-	-	-	-	-
Automatic carts, 95 gallon	-	-	-	-	-	-	-	-	-	-
Misc. Contracted Services	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000	22,000
Supplies	49,000	50,500	52,000	53,500	55,100	56,800	58,500	60,300	62,100	63,900
Fuel	**121,200**	**188,500**	**194,400**	**200,100**	**206,100**	**212,300**	**218,800**	**225,200**	**231,700**	**238,800**
Vehicle Fuel	121,200	124,700	128,600	132,400	136,300	140,400	144,800	149,000	153,200	157,900
Additional Fuel Charge for Direct Haul	-	63,800	65,800	67,700	69,800	71,900	74,000	76,200	78,500	80,900
Subtotal, Operation Expenses	**1,675,200**	**1,653,500**	**1,705,500**	**1,758,800**	**1,816,200**	**1,875,500**	**1,936,700**	**1,999,700**	**2,067,000**	**2,136,200**
NEW PROGRAM ALTERNATIVES										
PAYT	-	-	-	-	-	-	-	-	-	-
Transfer Station & Hauling	-	-	-	-	-	-	-	-	-	-
Yard Waste Processing Facility	-	-	-	-	-	-	-	-	-	-
New Landfill (Included in Charges by Landfill above)										
Organics Diversion	-	-	-	-	-	-	-	-	-	-
Subtotal, New Program Alternatives	-	-	-	-	-	-	-	-	-	-
TOTAL BUDGET, COLLECTION AND DISPOSAL	**3,361,300**	**3,390,200**	**3,494,200**	**3,601,300**	**3,714,000**	**3,830,100**	**3,950,000**	**4,073,400**	**4,202,900**	**4,336,100**
REVENUE										
Garbage Collection Revenue (Commercial front load service)	312,000	322,000	331,000	342,000	352,000	362,000	373,000	384,000	396,000	408,000
Special Trash Collection (bulky, white goods, yard waste, etc.)	8,000	8,000	9,000	9,000	9,000	10,000	10,000	10,000	10,000	11,000
Compactor Fees (2 downtown compactors)	40,000	41,000	43,000	44,000	45,000	47,000	48,000	49,000	51,000	52,000
Garbage Citations (Commercial and residential)	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	4,000	4,000
Sales: Yard Waste Carts	3,000	3,000	3,000	3,000	3,000	4,000	4,000	4,000	4,000	4,000
Solid Waste Disposal Tax	21,000	21,000	22,000	23,000	23,000	24,000	25,000	25,000	26,000	27,000
Total, Revenue, $	**387,000**	**398,000**	**411,000**	**424,000**	**435,000**	**450,000**	**463,000**	**475,000**	**491,000**	**506,000**
Net Costs (not including Capital Outlay) - Revenue	**2,974,300**	**2,992,200**	**3,083,200**	**3,177,300**	**3,279,000**	**3,380,100**	**3,487,000**	**3,598,400**	**3,711,900**	**3,830,100**

Exhibit 14-7. Example Output Summary From Pro Forma Model, Net Present Value of Program Scenario 3-day Per Week and 2-day Per Week Pickup Schedules

Program Scenario	Initial LF/TS	Disposal Options (NPV in $Million, Discount Factor of 5% over 30 years)																		
		DH to TS	DH to TS	DH to TS	DH to TS	DH to TS	New TS:TS to LF	New TS:TS to LF	New TS:TS to LF	New TS:TS to LF	New TS:TS to LF	New TS:TS to LF	New TS:TS to LF	Direct to LF	Direct to LF	Direct to LF	Direct to LF	Direct to LF	Direct to LF	Direct to LF
		City of Durham TS	Waste Industries - Durham Transfer Station	WMI - Raleigh Transfer Station	Siler City Transfer Station	East Wake Transfer Station	Austin Quarter SW Management Facility / Alamance County	South Wake Landfill	Upper Piedmont Environmental Landfill	Rockingham County Landfill	Southside Regional Landfill	Uwharrie - Montgomery	Hanes Mill Road LF	Austin Quarter SW Management Facility / Alamance County	South Wake Landfill	Upper Piedmont Environmental Landfill	Rockingham County Landfill	Southside Regional Landfill	Uwharrie - Montgomery	Hanes Mill Road LF
Collection Scenario: 3 Day Per Week Pickup																				
A	No New Program, No Automation, Keep Commercial	$66.2	$65.7	$72.3	$71.4	$69.1	$75.0	$71.3	$72.5	$74.1	$73.8	$71.8	$73.2	$64.4	$68.6	$72.0	$84.6	$85.6	$86.6	$87.8
B	No New Programs, Eliminate Commercial-Business, Keep Multi-Family	$66.0	$65.7	$70.5	$70.7	$69.3	$75.0	$72.3	$73.2	$74.3	$74.2	$72.6	$73.6	$64.6	$69.3	$72.3	$84.0	$85.0	$86.4	$87.3
C	No New Programs, Eliminate All Commercial	$55.8	$55.6	$58.5	$59.2	$58.7	$66.0	$64.3	$64.9	$65.6	$65.5	$64.5	$65.2	$54.9	$59.1	$61.5	$70.9	$71.7	$73.0	$73.6
D	Automate Residential Collection, Keep Commercial	$57.3	$56.8	$63.4	$62.2	$59.8	$66.3	$62.7	$63.9	$65.4	$65.2	$63.1	$64.5	$55.4	$59.0	$62.1	$73.4	$74.2	$74.9	$76.1
E	Automate Residential Collection, PAYT, Keep Commercial	$55.8	$55.4	$61.0	$60.6	$58.7	$64.8	$61.7	$62.7	$64.1	$63.9	$62.1	$63.3	$54.2	$58.2	$61.2	$72.3	$73.2	$74.1	$75.2
F	Automate Residential Collection, No PATY, Organics Diversion, Keep Commercial	$75.4	$74.9	$81.0	$80.2	$78.0	$84.4	$81.0	$82.1	$83.6	$83.4	$81.4	$82.7	$73.7	$77.5	$80.5	$91.6	$92.5	$93.3	$94.5
G	Automate Residential Collection, PAYT, Organics Diversion, Keep Commercial	$73.9	$73.6	$78.7	$78.6	$77.0	$83.0	$80.1	$81.0	$82.2	$82.1	$80.4	$81.5	$72.5	$76.7	$79.6	$90.6	$91.5	$92.5	$93.5
H	New Regional Landfill, Automation, Keep Commercial, No PAYT, No Organics Diversion	$57.3	$56.8	$63.4	$62.2	$59.8	$67.3	$66.7	$66.9	$67.2	$67.1	$66.8	$67.0	$56.8	$63.0	$65.2	$75.4	$76.4	$78.6	$78.8
I	New Regional Landfill, Automation, Keep Commercial, PAYT, Organics Diversion	$73.9	$73.6	$78.7	$78.6	$77.0	$83.7	$83.2	$83.4	$83.6	$83.6	$83.3	$83.5	$73.5	$79.8	$82.0	$92.1	$93.1	$95.4	$95.6
Collection Scenario: 2 Day Per Week Pickup																				
A	No New Program, No Automation, Keep Commercial	$71.1	$70.6	$77.2	$76.2	$73.7	$79.9	$76.2	$77.4	$78.9	$78.7	$76.6	$78.0	$69.2	$73.0	$76.4	$88.9	$89.9	$90.9	$92.1
B	No New Programs, Eliminate Commercial-Business, Keep Multi-Family	$71.1	$70.8	$75.7	$75.7	$74.1	$80.1	$77.4	$78.3	$79.4	$79.3	$77.7	$78.7	$69.7	$74.0	$77.0	$88.7	$89.7	$91.1	$92.0
C	No New Programs, Eliminate All Commercial	$60.8	$60.6	$63.5	$64.1	$63.4	$71.0	$69.3	$69.9	$70.6	$70.5	$69.5	$70.2	$59.9	$63.7	$66.0	$75.4	$76.2	$77.5	$78.1
D	Automate Residential Collection, Keep Commercial	$64.5	$64.0	$70.5	$69.4	$66.8	$73.3	$69.7	$70.9	$72.4	$72.2	$70.1	$71.5	$62.4	$65.5	$68.4	$79.4	$80.2	$80.8	$82.0
E	Automate Residential Collection, PAYT, Keep Commercial	$63.0	$62.6	$68.2	$67.8	$65.7	$71.8	$68.7	$69.7	$71.1	$70.9	$69.1	$70.3	$61.2	$64.7	$67.5	$78.3	$79.2	$80.0	$81.1
F	Automate Residential Collection, No PATY, Organics Diversion, Keep Commercial	$82.6	$82.1	$88.2	$87.4	$85.1	$91.4	$88.0	$89.2	$90.6	$90.4	$88.4	$89.7	$80.6	$83.9	$86.8	$97.7	$98.5	$99.3	$100.4
G	Automate Residential Collection, PAYT, Organics Diversion, Keep Commercial	$81.1	$80.8	$85.9	$85.8	$84.0	$90.0	$87.1	$88.0	$89.2	$89.1	$87.4	$88.5	$79.4	$83.2	$85.9	$96.6	$97.5	$98.5	$99.4
H	New Regional Landfill, Automation, Keep Commercial, No PAYT, No Organics Diversion	$64.5	$64.0	$70.5	$69.4	$66.8	$74.3	$73.7	$73.9	$74.2	$74.1	$73.8	$74.0	$63.7	$69.5	$71.5	$81.4	$82.4	$84.5	$84.7
I	New Regional Landfill, Automation, Keep Commercial, PAYT, Organics Diversion	$81.1	$80.8	$85.9	$85.8	$84.0	$90.7	$90.2	$90.4	$90.6	$90.6	$90.3	$90.5	$80.4	$86.3	$88.3	$98.1	$99.1	$101.3	$101.5
Long-term TS/LF		City of Durham TS	Waste Industries - Durham Transfer Station	WMI - Raleigh Transfer Station	Siler City Transfer Station	East Wake Transfer Station	Austin Quarter SW Management Facility / Alamance County	South Wake Landfill	Upper Piedmont Environmental Landfill	Rockingham County Landfill	Southside Regional Landfill	Uwharrie - Montgomery	Hanes Mill Road LF	Austin Quarter SW Management Facility / Alamance County	South Wake Landfill	Upper Piedmont Environmental Landfill	Rockingham County Landfill	Southside Regional Landfill	Uwharrie - Montgomery	Hanes Mill Road LF

Notes:
DH to TS = Direct Haul to Transfer Station
New TS: TS to LF = Construct new Transfer Station and transfer to landfill.
Direct to LF = Direct haul to a landfill outside of the Town and Orange County.

- Changing the residential collection schedule could provide cost savings to the Town and provide for better utilization of personnel and equipment. Changing the collection days would require rescheduling and re-routing for MSW and yard waste collections. More detailed routing studies are needed to assess the current performance of the residential collection system to develop an optimized routing network.

- Automating the Town's collection fleet appears to provide long-term potential cost savings, primarily through reduction in staffing costs (automated trucks require fewer people than the Town's current manual rear loader collection fleet).

- Implementing a PAYT program could potentially reduce the amount of waste requiring disposal and reduce long-term costs to the Town. The PAYT program costs include additional administrative support costs and the capital requirements for the purchase of collection containers and periodic replacement of these containers.

- Constructing a new transfer station within the Town limits and contracting with a landfill for disposal appears to yield only slightly higher costs to the Town when compared to direct hauling the MSW to other landfills as a long-term solution.

- Given the relatively low quantities of waste generated by the Town, implementing an organics diversion program (residential and/or commercial) would likely increase the Town's solid waste management costs; however, this conclusion would need to be reviewed periodically as new organic processing facilities are developed in the region. The costs included in the organics diversion analysis include additional costs for the separate collection of organics and processing costs. The Town should also consider public private partnerships that might improve the financial feasibility of organics diversion.

Other non-quantitative factors (such as those related to risk management, environmental impacts, socio-economic issues, sustainability, etc.) also need to be considered before a final decision is made regarding the "best" scenario for the Town.

Appendix A

Commercial Collections Evaluation

EVALUATION OF THE TOWN'S COMMERCIAL SOLID WASTE COLLECTION SERVICES

The pro forma model developed by SCS to evaluate the various solid waste program options for the Town also provides an estimate of the allocated costs for residential and commercial collection. The pro forma model further allocates the commercial collection costs between commercial-multi-family and commercial-business. The cost allocations were developed in conjunction with Town staff taking into account personnel and equipment assignments between residential and commercial collection functions. With this allocation, the cost of each service the Town provides can be compared against alternative delivery options such as contracting out, modifying, or eliminating services (e.g., commercial-business, commercial-multi-family, or both). A discussion of the methodology used to allocate the residential and commercial costs is provided below. In addition, commentary is provided on the Town's current commercial collection rates. The impact of either completely eliminating commercial collection services, or just providing commercial-multi-family collection services also is discussed.

SUMMARY OF TOWN COMMERCIAL WASTE COLLECTION SERVICES

As previously described in Section 2 of this Study, the Town currently provides both residential and commercial collection services. The Residential Collection service includes only single family residences and select multi-family complexes provided with roll-cart waste receptacles. The Commercial Collection service includes multi-family complexes, governmental buildings, schools, and commercial businesses; who primarily maintain front loader capable bulk dumpsters. In addition, a number of commercial customers, who either represent low disposal volumes or where dumpster space is limited, utilize roll-cart service similar to the residential collections. MSW collections from these customers are serviced by rear loader collection vehicles; therefore, these customers are not included in this analysis.

Single-family residential collection is provided once per week for each residence, performed over two (2) days, and is indirectly funded through the Town's annual tax rates. Similarly, multi-family residences, utilizing the Town dumpster services, are provided one collection per week through the commercial collection network. Additional pickups for multi-family customers, beyond the allocated once per week rate, are paid for separately in accordance with the Town's published rate structure. Respectively, the Town's true, commercial customers pay for collection and disposal service in accordance with this published rate structure. In all commercial sector scenarios, the customer owns or rents their dumpster receptacle from the private sector (e.g., Waste Industries, Waste Management, etc.). The Town does not engage in container sales or rental.

COMMERCIAL COLLECTION SERVICES FINANCIAL EVALUATION

Evaluation Methodology

SCS evaluated the Commercial Collections system, costs, and rate structure that the Town currently charges commercial businesses for collection and disposal of municipal solid waste.

The Town's current commercial rates are presented in Exhibit A-1. The rates are structured as a function of the size of container and the frequency of pickup.

The methodology used by SCS to evaluate the Town's commercial collections system costs and rate structure is summarized below:

1. SCS prepared an annual budget estimate for residential and commercial solid waste services for FY 2012-13, based on the Town's budget structure (see Exhibit A-2). SCS pro forma budget has very minor differences from the Town's draft FY 2012-13 budget because of differing assumptions on waste quantities, and other minor adjustments; however, these differences are not material.

2. SCS then allocated personnel salaries and budget line item costs to their respective residential and commercial functions based on our understanding of the Town's Solid Waste Services Division organization. Exhibit A-3 shows the assumed top-level residential and commercial cost allocations.

3. SCS then further subdivided the allocated commercial sector costs by allocating these commercial costs into two (2) separate categories: commercial-multi-family customers and commercial-businesses customers based on estimated volumes of waste collected from each commercial category (e.g., multi-family, businesses, schools, etc.) (see Exhibit A-5 and Exhibit A-6).

4. SCS evaluated the Town's commercial customer database and compiled the projected theoretical collection capacity per year in cubic yards and tons for each account type (e.g., business, restaurant, multi-family, etc.). The total collection capacity for each account type was calculated by adding the total number of containers of each size (i.e., 2, 4, 6, and 8 cy) for all collections accounts and including the collection frequency (i.e., 1 to 4 days per week). SCS calculated a total collection capacity of 6,038 cubic yards per week.

5. Using these collections data and the Town's projected Commercial Collections costs, SCS calculated the cost to pick each container and a cost per cubic yard for collection and disposal, as a function of container size and collection frequency. From these data, SCS developed a pro forma Commercial Collections rate table for comparison to the Town's existing rate structure (see Exhibit A-7).

6. Next, SCS assessed the "theoretical collection capacity" of the total number of dumpsters dispatched compared to the actual quantities of waste collected (in tons) to assess utilization factor of collection capacity (see bottom section of Exhibit A-5).

7. SCS estimated the rate for collecting a single dumpster to be based on allocated costs and the assumption that the dumpster is 70% full (see Exhibit A-8).

Exhibit A-1. Town of Chapel Hill Commercial Collection Fees, FY 2012-13

Annual Costs

Basic Service (Front Load)

Container Size	1x/week	2x/week	3x/week	4x/week	5x/week	Extra Lift
2 yard	$375.00	$725.00	$1,075.00	$1,775.00	$2,225.00	
4 yard	$550.00	$900.00	$1,225.00	$1,950.00	$2,400.00	$50.00
6 yard	$725.00	$1,075.00	$1,400.00	$2,125.00	$2,575.00	Flat Rate
8 yard	$900.00	$1,250.00	$1,575.00	$2,300.00	$2,750.00	

Residential Commercial Service

Container	Fee
Up to 7 Containers, 1x/week	$250.00
Each Additional Container	$40.00

Guidelines:

1. "Extra Lift" refers to dumping container in addition to contracted service.
2. Multi-family units receive one 8-yard container at 1x/week per 25 units for free; charges apply thereafter.

Collection of White Goods

Up to Three Items*	$15.00
Each Additional Item	$5.00

*15.00 Minimum for Each Collection

Compactor Service (annualized cost)

High Volume	$1,500.00
Medium Volume	$750.00
Low Volume	$280.00

Roll-Off Container Rental (Yard Waste Only)

Weekday	$20.00
Weekend	$25.00

Source: http://www.ci.chapel-hill.nc.us/index.aspx?page=1142

Exhibit A-2. Projected FY 2012-13 Solid Waste Budget

Scenario: Current, No new route, Orange County LF, No Automate Residential Scenario A Annual Budget	Residential Allocation ($)	Commercial Allocation ($)	Commercial-Multi-Family ($)	Commercial-Business ($)	Total ($)
	2013	2013	2013	2013	2013
Item	6/30/2013	6/30/2013	6/30/2013	6/30/2013	6/30/2013
TOWN SOLID WASTE BUDGET					
Collection Personnel Services					
Salaries - Full-Time (Including Benefits)	1,408,600	223,800	119,100	104,700	1,632,400
Other Pay	1,900	-	-	-	1,900
Workers Comp Insurance	41,800	10,000	5,300	4,700	51,800
Subtotal, Collection Personnel Services	**1,452,300**	**233,800**	**124,400**	**109,400**	**1,686,100**
Collection Operating Expenses					
Professional Services	400	100	100	-	500
Personnel Agency Payments	7,300	1,700	900	800	9,000
Business Meetings & Training	3,700	900	500	400	4,600
Career Development Training	900	200	100	100	1,100
Advertising	2,000	500	300	200	2,500
Uniform Rentals	10,100	2,400	1,300	1,100	12,500
Landfill Fines	1,100	1,400	700	700	2,500
Charges by Landfill	**449,700**	**489,600**	**260,500**	**229,100**	**939,300**
MSW	396,200	489,600	260,500	229,100	885,800
Yard Waste	53,500	-	-	-	53,500
Fleet Use Charges	**166,400**	**34,000**	**-**	**34,000**	**200,400**
Vehicle Replacement Charges	**270,200**	**40,400**	**-**	**40,400**	**310,600**
Misc. Contracted Services	4,800	17,300	8,600	8,600	22,000
Supplies	39,600	9,400	5,000	4,400	49,000
Fuel	**93,600**	**27,600**	**-**	**27,600**	**121,200**
Subtotal, Operation Expenses	**1,049,800**	**625,500**	**278,000**	**347,400**	**1,675,200**
TOTAL BUDGET, COLLECTION AND DISPOSAL	2,502,100	859,300	402,400	456,800	3,361,300
REVENUE					
Garbage Collection Revenue (Commercial front load service)	-	312,000	47,000	265,000	312,000
Special Trash Collection (bulky, white goods, yard waste, etc.)	8,000	-	-	-	8,000
Compactor Fees (2 downtown compactors)	-	40,000	-	40,000	40,000
Garbage Citations (Commercial and residential)	1,300	1,700	700	1,000	3,000
Sales: Yard Waste Carts	3,000	-	-	-	3,000
Solid Waste Disposal Tax	9,400	11,600	6,200	5,400	21,000
Total, Revenue, $	21,700	365,300	53,900	311,400	387,000
Net Costs (not including Capital Outlay) - Revenue	**2,480,400**	**494,000**	**348,500**	**145,400**	**2,974,300**

Note:
The line items in Red are inputs from the pro forma analysis prepared by SCS. This budget reflects the "status quo" scenario.

Exhibit A-3. Residential and Commercial Cost Allocations

Operating Expenses Allocation	Residential Allocation, %	Commercial Allocation, %
FY	2013	2013
Year Ending	6/30/2013	6/30/2013
Professional Services	81%	19%
Personnel Agency Payments	81%	19%
Business Meetings & Training	81%	19%
Career Development Training	81%	19%
Dues & Subscriptions	81%	19%
Pagers	81%	19%
Cellular Phones	81%	19%
Advertising	81%	19%
Personnel Advertising	81%	19%
Equipment Rentals	81%	19%
Uniform Rentals	81%	19%
Landfill Fines	45%	55%
Charges by Landfill	45%	55%
Fleet Use Charges	87%	13%
Vehicle Replacement Charges	87%	13%
Misc. Contracted Services	22%	78%
Supplies	81%	19%
Vehicle Fuel	87%	13%

Exhibit A-4. Residential and Commercial Allocation: Multi-Family and Business Accounts

Collection Scenario	FY 2013
Residential	A
Commercial	A
Cost Allocation %	
Tonnage	
Residential	44.7%
Commercial	55.3%
Commercial-Residential (multi-family)	29.4%
Commercial-Business	25.9%
Staff #	
Residential	80.8%
Commercial	19.2%
Commercial-Residential (multi-family)	10.2%
Commercial-Business	9.0%
Truck Fuel & OM Costs	
Residential	87%
Commercial	13%
Commercial-Residential (multi-family)	0%
Commercial-Business	13%
Miscellaneous Contract Services	
Residential	22%
Commercial	78%
Commercial-Residential (multi-family)	39%
Commercial-Business	39%

Notes:
1. Residential Scenario "A" is status quo
2. Commercial Scenario "A" is status quo
3. Percentages may vary by year depending on scenario being evaluated

Exhibit A-5. Commercial Collection By Account Type

Commercial Account Type	Collection Frequency (x per week)	Container Size, Cubic Yards 2	4	6	8	Total (CY/Week)
		Number of Accounts				
BUSINESS (Total)		**4**	**72**	**102**	**1,568**	**1,746**
	1	4	56	36	504	600
	2	-	16	48	560	624
	3	-	-	18	312	330
	4	-	-	-	192	192
BUSINESS,RESTAURANT (Total)		**-**	**-**	**-**	**64**	**64**
	4	-	-	-	64	64
GOVERNMENT (Total)		**-**	**-**	**-**	**72**	**72**
	1	-	-	-	8	8
	2	-	-	-	64	64
MULTI-FAMILY GOVERNMENT (Total)		**-**	**-**	**-**	**32**	**32**
	1	-	-	-	16	16
	2	-	-	-	16	16
MULTI-FAMILY (Total)		**-**	**-**	**42**	**2,784**	**2,826**
	1	-	-	42	1,384	1,426
	2	-	-	-	1,216	1,216
	3	-	-	-	24	24
	4	-	-	-	160	160
RESTAURANT (Total)		**-**	**-**	**24**	**432**	**456**
	1	-	-	12	48	60
	2	-	-	12	144	156
	3	-	-	-	72	72
	4	-	-	-	128	128
	5	-	-	-	40	40
SCHOOL (Total)		**-**	**-**	**18**	**824**	**842**
	1	-	-	18	24	42
	2	-	-	-	32	32
	3	-	-	-	768	768
Grand Total		**4**	**72**	**186**	**5,776**	**6,038**

Multi-Family Allocation based on collection volume capacity 47%

Theoretical collection capacity calculation:

Disposal Capacity, cy/week	6,038	cy/week
	52	weeks
Disposal Capacity, cy/year	313,976	cy/year
Density (lbs/cy)	300	lbs/cy
Disposal Capacity, tons	47,096	tons/year
Projected Commercial Collection FY 2013, tons/year	8,590	tons/year
Utilization factor	18%	

Note: Commercial Account Type names are taken directly from Town's database.

Exhibit A-6. Summary of Commercial Accounts By Type

Category	Sum of Days Collected	Account Designation
BUSINESS	182	Business
BUSINESS,RESTARAUNT	4	Business
GOVERNMENT	5	Town
MULTI-FAMILY GOVERNMENT	4	Town
MULTI-FAMILY	125	Town
RESTARAUNT	55	Business
SCHOOL	50	Business
Grand Total	**425**	
Business Accounts, number	291	
Town Accounts, number	0	
Business	68%	
Town[1,2]	0%	

1. Used to calculate reduction factor if business-commercial is eliminated (fuel usage)

2. Town accounts refer to accounts where one pickup per week is provided without additional charge

3. Category names per Town's database.

Exhibit A-7. Pro Forma Rate Schedule for Commercial-Business Collection

Rational for Commercial Pricing	FY 2013			
1. **Commercial Collected Capacity, cubic yards/year**	**313,976**	**cy**		
Commercial-Residential (Multi-Family)	148,616	cy/year		
Commercial-Business	165,360	cy/year		
2. **Commercial Collected, tons/year**	**8,590**	**tons**		
Commercial-Residential (Multi-Family)	4,570	tons		53%
Commercial-Business	4,020	tons		47%
	Total	**Collection**	**Disposal**	
3. **Commercial Costs, $/year**	**$ 859,200**	**$ 369,600**	**$ 489,600**	
Commercial-Residential (Multi-Family)	$ 402,400	$ 141,900	$ 260,500	
Commercial-Business	$ 456,800	$ 227,700	$ 229,100	

4. **Allocation Statistics**	**Picks/Year**	**CY/Year**
Commercial	**40,196**	**313,976**
Commercial-Residential (Multi-Family)	18,668	148,616
Commercial-Business	21,528	165,360

	Total/CY	**$/pick**	**$/CY**
5. **Commercial Rates**	**$ 2.74**	**9.19**	**$1.56**
Commercial-Residential (Multi-Family)	$ 2.71	**7.6**	$1.75
Commercial-Business	$ 2.76	**10.58**	$1.39

6. **Projected Rate Table Based on Actual/Projected Costs and Collection Capacity**

Projected tip Fee Rate ($/ton) **$57.00**

a. Frequency of Pickup

	Frequency of Pickup/Week				
	1	2	3	4	5
Picks/Year	52	104	156	208	260

b. Collection Costs

Container Size	$/Pick	Frequency of Pickup/Week 1	2	3	4	5
2 cy	9.19	$478	$956	$1,434	$1,912	$2,389
4 cy	9.19	$478	$956	$1,434	$1,912	$2,389
6 cy	9.19	$478	$956	$1,434	$1,912	$2,389
8 cy	9.19	$478	$956	$1,434	$1,912	$2,389

Exhibit A-7. Pro Forma Rate Schedule for Commercial-Business Collection

c. Disposal

Container Size	$/CY	Frequency of Pickup/Week 1	2	3	4	5
2 cy	1.56	$162	$324	$487	$649	$811
4 cy	1.56	$324	$649	$973	$1,297	$1,622
6 cy	1.56	$487	$973	$1,460	$1,946	$2,433
8 cy	1.56	$649	$1,297	$1,946	$2,595	$3,243

d. Collection + Disposal

Container Size	Frequency of Pickup/Week 1	2	3	4	5	Single Pickup*
2 cy	$640	$1,280	$1,921	$2,561	$3,200	$18
4 cy	$802	$1,605	$2,407	$3,209	$4,011	$28
6 cy	$965	$1,929	$2,894	$3,858	$4,822	$37
8 cy	$1,127	$2,253	$3,380	$4,507	$5,632	$46

* Single pickup based on collection cost plus disposal fee assuming 70% full container.

e. Town's Current Rates, $/year

Container Size	Frequency of pickup per week 1	2	3	4	5	Single Pickup*
2 cy	$375	$725	$1,075	$1,775	$2,225	$50
4 cy	$550	$900	$1,225	$1,950	$2,400	$50
6 cy	$725	$1,075	$1,400	$2,125	$2,575	$50
8 cy	$900	$1,250	$1,575	$2,300	$2,750	$50

f. Comparison of Calculated Rates to Town's Current Rates, $/year

2 cy	($265)	($555)	($846)	($786)	($975)	$32
4 cy	($252)	($705)	($1,182)	($1,259)	($1,611)	$22
6 cy	($240)	($854)	($1,494)	($1,733)	($2,247)	$13
8 cy	($227)	($1,003)	($1,805)	($2,207)	($2,882)	$4

g. Ratio of Current Town Rates/SCS Assessment of Allocated Costs of Service, %

2 cy	59%	57%	56%	69%	70%	278%
4 cy	69%	56%	51%	61%	60%	179%
6 cy	75%	56%	48%	55%	53%	135%
8 cy	80%	55%	47%	51%	49%	109%

Conclusion: The Town's budgeted commercial rates appear below the projected cost for the service provided based on the allocation methodolgy shown above.

Exhibit A-8. Single Pickup Rate Analysis

Percent Full>>>	70%	Rate	$57.00	/ton	
Container Size	**Density (lbs/cy)**	**Weight Per Pickup (tons)**	**Collection ($)**	**Disposal ($)**	**Single Pickup**
2 cy	**300**	0.21	$9.19	$9.19	$18.38
4 cy	**300**	0.42	$9.19	$18.39	$27.58
6 cy	**300**	0.63	$9.19	$27.58	$36.77
8 cy	**300**	0.84	$9.19	$36.78	$45.97

Findings

The following observations are provided regarding the Town's current commercial-business collection rate fee schedule:

- The Town has the capacity (assuming the dumpsters were 100% full each time they were emptied) to collect approximately 314,000 cubic yards of commercial waste per year based on the current census of dumpsters and scheduled pickup frequency (i.e., number of times collected per week). If this capacity were fully utilized, the Town could collect approximately 47,000 tons per year of commercial waste, assuming a commercial waste density of 300 pounds per cubic yard. The Town currently collects approximately 8,590 tons per year of commercial municipal solid waste, which represents an 18% utilization factor. This utilization factor is likely influenced by the fluctuation in population and waste generation caused by the college academic calendar, practical logistics associated with servicing dumpsters for highly variable waste generation customers (e.g., larger dumpsters are typically deployed at multi-family apartments, such that the peak demand from the university population may be met), and the relatively inexpensive rates currently charged for the larger size dumpsters.

- SCS's analysis of the current dumpster service rates for commercial-business customers suggests that the rates charged by the Town do not cover the cost for the service provided. However, the rates appear to cover the Town's tipping fee incurred for most levels of service, with the exception of the 8 cubic yard dumpster service (see Exhibit A-7, Items 7d vs. 7e, which breaks out the estimated disposal charges as a function of the level of service and the current utilization factor of 18%). Item 7f in Exhibit A-7 shows the increase in rates that would be needed to fully cover the allocated costs.

- SCS performed a preliminary review of the Town's commercial customer database. The database includes a list of all the customers, the number and capacity of the collection containers (e.g., 2, 4, 6, or 8 cubic yard), the frequency of pick-up per week (1 to 5 times per week), and the "invoice" amount. The database shows the paying

and non-paying customers. The paying customers are the commercial businesses in the Town that use the service. The "non-paying" customers include commercial-multi-family accounts (with the provision of one "free" pickup per week, with additional pickups paid at the published rates), and other governmental entities. The invoice amount shown in the database generally tracks the Town's published collection rates; however, there are numerous exceptions and variances that were noted. SCS understands the Town has audited these accounts to correct inconsistencies and gaps.

Recommendations

- Conduct a service audit of the current commercial-business and commercial-multi-family accounts to assess the adequacy of the current service levels in terms of the size and number of the containers, utilization rate of the container, and the frequency of pickup. Some efficiency in service could potentially be realized based on the estimated current utilization factor of 18%. Recognizing the Town does not have control over the size of container provided by private sector firms, adjustments to the collection frequency by the Town would balance this utilization factor. For example, if an account is utilizing multiple collection days during the week, however the container is routinely less than full; the Town may adjust the collection frequency downward, thus resulting in a more efficient use of Town collections resources. However, in adjusting collection frequency the Town must also consider the potential downside risk associated with the excess capacity actually being used, which could increase its disposal costs, without any increase in revenues.

- Consider adjustment to the commercial-business fee structure to increase revenues to more closely reflect the allocated costs for this service. We understand that the current rates charged by commercial haulers must also be considered in any adjustments. Additional revenues also may be recognized with the recent the audit of the commercial accounts.

COMMERCIAL COLLECTION SCENARIO-SPECIFIC ANALYSIS AND RESULTS

SCS evaluated the following service modifications to the Commercial Collections system:

- Elimination of all Commercial Collections services, including commercial-business and commercial-multi-family;

- Elimination of just the commercial-business service, while the Town continues to provide commercial-multi-family collections service; and,

- Evaluation of the value of a subsidy the Town may choose to support private-sector collections of the commercial-multi-family customers currently served by the Town.

The projected costs and revenues associated with the status quo and the two commercial collection service scenarios considered are in Exhibit A-2 above (Status Quo), Exhibit A-9

(eliminate all commercial collection), and Exhibit A-10 (keep commercial-multi-family and eliminate commercial-business).

Exhibit A-9. Pro Forma Allocated Budget Costs and Revenues FY 2012-13 (Keep Commercial-Multi-Family, Eliminate Commercial-Business)

	[A]	[B]=[C]+[D]	[C]	[D]	[E]=[A]+[B]
Scenario: Current, No new route, Orange County LF, No Automate Residential Scenario A, Commercial: Eliminate All Commercial					
Annual Budget	**Residential Allocation ($)**	**Commercial Allocation ($)**	**Commercial-Multi-Family ($)**	**Commercial-Business ($)**	**Total ($)**
	2013	**2013**	**2013**	**2013**	**2013**
Item	**6/30/2013**	**6/30/2013**	**6/30/2013**	**6/30/2013**	**6/30/2013**
TOWN SOLID WASTE BUDGET					
Collection Personnel Services					
Salaries - Full-Time (Including Benefits)	1,440,200	-	-	-	1,440,200
Other Pay	1,900	-	-	-	1,900
Workers Comp Insurance	51,800	-	-	-	51,800
Subtotal, Collection Personnel Services	**1,493,900**	**-**	**-**	**-**	**1,493,900**
Collection Operating Expenses					
Professional Services	400	-	-	-	400
Personnel Agency Payments	7,300	-	-	-	7,300
Business Meetings & Training	3,700	-	-	-	3,700
Career Development Training	800	-	-	-	800
Advertising	2,000	-	-	-	2,000
Uniform Rentals	10,100	-	-	-	10,100
Landfill Fines	2,500	-	-	-	2,500
Charges by Landfill	**449,700**	**-**	**-**	**-**	**449,700**
MSW	396,200	-	-	-	396,200
Yard Waste	53,500	-	-	-	53,500
Fleet Use Charges	**166,400**	**-**	**-**	**-**	**166,400**
Vehicle Replacement Charges	**242,400**	**-**	**-**	**-**	**242,400**
Misc. Contracted Services	-	-	-	-	-
Supplies	39,600	-	-	-	39,600
Fuel	**93,600**	**-**	**-**	**-**	**93,600**
Subtotal, Operation Expenses	**1,018,500**	**-**	**-**	**-**	**1,018,500**
TOTAL BUDGET, COLLECTION AND DISPOSAL	2,512,400	-	-	-	2,512,400
REVENUE					
Garbage Collection Revenue (Commercial front load service)	-	-	-	-	-
Special Trash Collection (bulky, white goods, yard waste, etc.)	8,000	-	-	-	8,000
Compactor Fees (2 downtown compactors)	-	-	-	-	-
Garbage Citations (Commercial and residential)	-	-	-	-	-
Sales: Yard Waste Carts	3,000	-	-	-	3,000
Solid Waste Disposal Tax	-	-	-	-	-
Total, Revenue, $	11,000	-	-	-	11,000
Net Costs (not including Capital Outlay) - Revenue	**2,501,400**	**-**	**-**	**-**	**2,501,400**

Exhibit A-10. Pro Forma Allocated Budget Costs and Revenues FY 2012-13 (Eliminate All Commercial-Collection)

	[A]	[B]=[C]+[D]	[C]	[D]	[E]=[A]+[B]
Scenario: Current, No new route, Orange County LF, No Automate Residential Scenario A, Commercial: Eliminate Commerical-Business Only, Keep Multi-Family					
Annual Budget	Residential Allocation ($)	Commercial Allocation ($)	Commercial-Multi-Family ($)	Commercial-Business ($)	Total ($)
	2013	2013	2013	2013	2013
Item	6/30/2013	6/30/2013	6/30/2013	6/30/2013	6/30/2013
TOWN SOLID WASTE BUDGET					
Collection Personnel Services					
Salaries - Full-Time (Including Benefits)	1,483,600	104,200	104,200	-	1,587,800
Other Pay	1,900	-	-	-	1,900
Workers Comp Insurance	51,800	-	-	-	51,800
Subtotal, Collection Personnel Services	**1,537,300**	**104,200**	**104,200**	**-**	**1,641,500**
Collection Operating Expenses					
Professional Services	400	100	100	-	500
Personnel Agency Payments	7,300	1,100	1,100	-	8,400
Business Meetings & Training	3,700	600	600	-	4,300
Career Development Training	800	100	100	-	900
Advertising	2,000	300	300	-	2,300
Uniform Rentals	10,100	1,500	1,500	-	11,600
Landfill Fines	1,500	1,000	1,000	-	2,500
Charges by Landfill	**449,600**	**260,500**	**260,500**	**-**	**710,100**
MSW	396,100	260,500	260,500	-	656,600
Yard Waste	53,500	-	-	-	53,500
Fleet Use Charges	**166,400**	**34,000**	**34,000**	**-**	**200,400**
Vehicle Replacement Charges	**277,400**	**33,200**	**33,200**	**-**	**310,600**
Misc. Contracted Services	1,000	3,800	3,700	-	4,700
Supplies	39,600	-	-	-	39,600
Fuel	**93,600**	**-**	**-**	**-**	**93,600**
Subtotal, Operation Expenses	**1,053,400**	**336,200**	**336,100**	**-**	**1,389,500**
TOTAL BUDGET, COLLECTION AND DISPOSAL	2,590,700	440,400	440,300	-	3,031,000
REVENUE					
Garbage Collection Revenue (Commercial front load service)	-	47,000	47,000	-	47,000
Special Trash Collection (bulky, white goods, yard waste, etc.)	8,000	-	-	-	8,000
Compactor Fees (2 downtown compactors)	-	-	-	-	-
Garbage Citations (Commercial and residential)	-	-	-	-	-
Sales: Yard Waste Carts	3,000	-	-	-	3,000
Solid Waste Disposal Tax	12,700	8,300	8,300	-	21,000
Total, Revenue, $	23,700	55,300	55,300	-	79,000
Net Costs (not including Capital Outlay) - Revenue	**2,567,000**	**385,100**	**385,000**	**-**	**2,952,000**

Eliminate All Commercial Collection Services

SCS evaluated the costs and revenue changes that would occur if the Town were to eliminate all Commercial Collection services, If the Town were to cease all commercial services, the following changes to the Town's budget would likely occur:

- **Staffing and Staffing Related Expenses.** SCS assumed that the Town's collection staffing would change if the commercial collection service was eliminated. Under this scenario, the three (3) equipment operator staff allocated to commercial collections services would be removed from the Town payroll. The projected budgetary staffing impact for this scenario is presented below in Exhibit A-11, Collection Scenario C. A potential negative consequence of eliminating these positions is that we understand that these staff also operate other equipment and work on other tasks within the Department of Solid Waste Services (e.g., knuckleboom

truck for bulky waste pickup). This would have to be considered prior to any decision to eliminate staff positions.

Exhibit A-11. Estimation of Staff Costs for Commercial Collection Scenarios

Collection Scenario	Item	2013
A	Residential	1,408,565
	Commercial	223,833
	Total	**1,632,398**
B	Residential	$ 1,483,565
	Commercial	$ 104,238
	Total	**1,587,803**
C	Residential	$ 1,440,239
	Commercial	$ -
	Total	**1,440,239**

- **Fleet Usage/Maintenance Charges.** SCS assumed the fleet use charges associated with the front loader collection vehicles would be eliminated from the budget with the elimination of Commercial Collections services.

- **Fuel.** SCS assumed a significant reduction in fuel charges, proportional to the two (2) front loader vehicles not operating.

- **Vehicle Replacement Cost.** SCS assumed that the vehicle replacement costs allocated in the budget would be eliminated if the Commercial Collection services were eliminated.

- **Tip Fees.** SCS assumed the Town would no longer be responsible for paying tip fees for all commercial accounts.

If the Town were to entirely eliminate the Commercial Collection services, SCS estimates that the Town could realize approximately $849,000/year in reduced costs; however, approximately $376,000/year in revenues would be lost, for a net savings of approximately $473,000/year (see Exhibit A-12).

Furthermore, SCS would note that with the elimination of these Commercial Collections services, the Town would need to consider these cost impacts to its public sector customers (i.e., public housing, parks and recreation, government offices,, etc.) and allocate these costs to these departments accordingly.

Eliminate Commercial-Business Collection Services

Similarly, SCS evaluated the costs and revenue changes that would occur if the Town were to eliminate the commercial-business collection services, but maintain the multi-family collection.

If the Town were to stop providing collection to commercial-businesses customers, the following changes to the Town's budget would likely occur:

- **Staffing and Staffing Related Expenses.** SCS assumed that the Town's collection staffing would change if the commercial-business collection service was eliminated. Under this scenario, one (1) of the three (3) equipment operator staff allocated to commercial collections services would be removed from the Solid Waste Services Division's payroll (and potentially reassigned elsewhere in the Town if position were available) The remaining two (2) equipment operators would continue to collect weekly from the commercial-multi-family customers using the two (2) front loader trucks. The projected budgetary staffing impact for this scenario is presented above in Exhibit A-11, Collection Scenario B.

- **Fleet Usage/Maintenance Charges.** SCS assumed no change in fleet use charges, since both of the commercial vehicles would likely still be used and require the same degree of maintenance. This is a conservative assumption, since some reduction in maintenance likely would result if the commercial-business accounts were no longer serviced.

- **Fuel.** SCS assumed a 68% reduction in fuel charges, which is based on the proportional distribution of pickups between "Town" and "Commercial-Business" accounts (see Exhibit A-6). In other words, commercial-business pickups represent 68% of the total commercial pickups serviced by the Town in a given week.

- **Vehicle Replacement Cost.** SCS assumed that the vehicle replacement costs would be reduced if the commercial collection services were eliminated. The current vehicle replacement cost budget was reduced by the 7-year amortization rate of the commercial collection vehicles (4% interest).

- **Tip Fees.** SCS assumed the Town would no longer be responsible for paying tip fees for commercial-business accounts, except for waste collected at Town-owned properties.

If the Town were to eliminate the commercial-business collection services (keeping multi-family), SCS estimates that the Town could realize approximately $330,000/year in reduced costs; however, approximately $308,000/year in revenues would be lost, for a net savings of approximately $22,000/year (see Exhibit A-12). This probably represents a wash given the assumptions associated with the cost allocations between commercial-business and commercial-multi-family operations and the uncertainties inherent in these types of cost projection and allocation models.

Exhibit A-12. Pro Forma Analysis, Summary of Commercial Collection Service Scenarios

Annual Budget Item	Status Quo Total ($) 2013 6/30/2013	Eliminate All Commercial Total ($) 2013 6/30/2013	Change ($)	Eliminate Commercial-Business Only Total ($) 2013 6/30/2013	Change ($)
TOWN SOLID WASTE BUDGET					
Collection Personnel Services					
Salaries - Full-Time (Including Benefits)	1,632,400	1,440,200	192,200	1,587,800	44,600
Other Pay	1,900	1,900	-	1,900	-
Salaries - Overtime	-	-	-	-	-
Salaries - Temporary	-	-	-	-	-
FICA	-	-	-	-	-
Retirement	-	-	-	-	-
Group Insurance	-	-	-	-	-
Retiree Medical	-	-	-	-	-
Workers Comp Insurance	51,800	51,800	-	51,800	-
Additional Labor From Direct Haul	-	-	-	-	-
Subtotal, Collection Personnel Services	**1,686,100**	**1,493,900**	**192,200**	**1,641,500**	**44,600**
			-		-
Collection Operating Expenses			**-**		**-**
Professional Services	500	400	100	500	-
Personnel Agency Payments	9,000	7,300	1,700	8,400	600
Business Meetings & Training	4,600	3,700	900	4,300	300
Career Development Training	1,100	800	300	900	200
Dues & Subscriptions	-	-	-	-	-
Pagers	-	-	-	-	-
Cellular Phones	-	-	-	-	-
Advertising	2,500	2,000	500	2,300	200
Personnel Advertising	-	-	-	-	-
Equipment Rentals	-	-	-	-	-
Uniform Rentals	12,500	10,100	2,400	11,600	900
Landfill Fines	2,500	2,500	-	2,500	-
Charges by Landfill	**939,300**	**449,700**	**489,600**	**710,100**	**229,200**
MSW	885,800	396,200	489,600	656,600	229,200
Yard Waste	53,500	53,500	-	53,500	-
Fleet Use Charges	**200,400**	**166,400**	**34,000**	**200,400**	**-**
Fleet Use Charges	200,400	166,400	34,000	200,400	-
Additional Fleet Use Charges for Direct Haul	-	-	-	-	-
Vehicle Replacement Charges	**310,600**	**242,400**	**68,200**	**310,600**	**-**
County Budgeted Vehicle Replacement Charge	310,600	242,400	68,200	310,600	-
New Vehicle for new route	-	-	-	-	-
Automatic carts, 95 gallon	-	-	-	-	-
Misc. Contracted Services	22,000	-	22,000	4,700	17,300
Supplies	49,000	39,600	9,400	39,600	9,400
Fuel	**121,200**	**93,600**	**27,600**	**93,600**	**27,600**
Vehicle Fuel	121,200	93,600	27,600	93,600	27,600
Additional Fuel Charge for Direct Haul	-	-	-	-	-
Subtotal, Operation Expenses	**1,675,200**	**1,018,500**	**656,700**	**1,389,500**	**285,700**
TOTAL BUDGET, COLLECTION AND DISPOSAL	3,361,300	2,512,400	848,900	3,031,000	330,300
REVENUE			-		-
Garbage Collection Revenue (Commercial front load service)	312,000	-	312,000	47,000	265,000
Special Trash Collection (bulky, white goods, yard waste, etc.)	8,000	8,000	-	8,000	-
Compactor Fees (2 downtown compactors)	40,000	-	40,000	-	40,000
Garbage Citations (Commercial and residential)	3,000	-	3,000	-	3,000
Sales: Yard Waste Carts	3,000	3,000	-	3,000	-
Solid Waste Disposal Tax	21,000	-	21,000	21,000	-
Total, Revenue, $	387,000	11,000	376,000	79,000	308,000
			-		-
Net Costs (not including Capital Outlay) - Revenue	**2,974,300**	**2,501,400**	**472,900**	**2,952,000**	**22,300**

Subsidize Private-Sector Commercial-Multi-Family Collections

Using these analyses, SCS was able to estimate the value of providing commercial-multi-family collections according to the level of service the Town is currently providing. SCS estimates the cost for the Town to provide collection for multi-family accounts is approximately $402,400/year, with offsetting revenues of $54,000/year, for a net cost of $349,000 /year (see Exhibit A-2). Using these data, the Town may evaluate how it may subsidize the cost of privatized commercial-multi-family collections if it so chooses.

Based on SCS's experience in the industry, subsidizing such collection services for private, multi-family housing is rare. However, SCS is aware a decision to either provide or forego a subsidy involves other intangible metrics in addition to this financial analysis, such as: the Town's values, level of service expectations, citizen equality, and private development.

Separating Apartment Complexes from Condos/Townhomes

SCS evaluated what the impact would be if the commercial-multi-family collections from only Townhomes and Condominiums were given the discounted rates (i.e., one collection per week at no fee), while apartments and other multi-family establishments that aren't so categorized were charged the full rates for all collections. A preliminary analysis of the revenue impact of modifying the Town's billing practices to charge non-townhomes and condominium customers the full rates without discount was prepared. There may be other establishments that in a more extensive analysis would also be granted the discounted rates. The net revenue increase the Town might expect is about $135,000 per year.

SCS did not analyze the option of the Town only collection from the condos and townhomes, but suspect the Town would lose significant revenue but still have the basic labor and equipment costs, although operational costs would reduce somewhat (fuel, maintenance), as would the respective disposal costs.

Conclusions and Recommendations Regarding Commercial Collection

A summary comparison of each of the commercial collection scenarios evaluated is presented in Exhibit A-12. No significant economic benefit would be achieved by simply eliminating the Town's commercial-business collection program. SCS's analysis suggests that only a nominal savings of $22,000/year could be achieved; however, given the number of variables and assumptions associated with the cost allocations between commercial and residential collection programs and the commercial-business and commercial-multi-family functions, the projected savings are well within the margin of error of the analysis.

Another scenario that was considered is to continue collection to residential properties (e.g., townhomes and condos), eliminate large multi-family collections (e.g., multiplex apartments) and commercial account collections. Financial analysis of this specific scenario was not performed. Because there would be some further reduction in costs, but no additional revenue, the ballpark estimated savings is believed to be in the $50,000 to $75,000 per year range.

Eliminating the commercial collection program entirely would reduce the Town's costs by approximately $473,000/ year; however, this likely would be offset by a reduction in tax revenue derived from multi-family units since the once-per-week collection service and benefit (approximately $349,000/year) would no longer be provided. However, even considering this factor, a savings likely could be realized.

In summary, SCS recommends the Town continue commercial bulk collections.

Commercial-Business Collection Revenue Compared to Costs

SCS's analysis suggests that the Town's current commercial collection revenues do not offset its costs for the service provided. We estimate the deficit is approximately $145,000 per year (see Exhibit A-2). However, this deficit is based on the allocation methodology described above, which could be changed to allocate more of the base costs for this service to the multi-family collection function; thereby reducing or eliminating this projected deficit. The Town annually evaluates its commercial rates and compares them against private sector rates and makes adjustments accordingly. Overall, providing services to commercial businesses helps offset costs; however, the most significant risk is the percent utilization of the disposal capacity available in the collection containers currently deployed, which if fully utilized could result in a substantial increase in disposal costs.

Appendix B

Evaluation of Multi-Family Waste Collection and Disposal Service Levels

EVALUATION OF MULTI-FAMILY WASTE COLLECTION AND DISPOSAL SERVICE LEVELS

BULK CONTAINER SERVICE VS. ROLL-CART SERVICE

With this comprehensive review of soil waste collection and disposal options, the Town requested a case study analysis of its current multi-family collection service and policies. The purpose of this analysis is to aid in determining an appropriate service level for when residential roll-cart collection service may be warranted for multi-family units in lieu of the Town's bulk container service currently provided by commercial collections staff.

SUMMARY OF TOWN MULTI-FAMILY WASTE COLLECTION SERVICES

As previously described in Section 2 of this Study, multi-family properties throughout the Town rent, lease, or purchase bulk container(s) provided by a private-sector vendor. The Town provides the associated collection and disposal services. Based on Town collection records, multi-family collection includes approximately 265 total bulk containers of either 6 or 8 cubic yard capacities. The combined maximum capacity of these containers is calculated 2,858 cy, representing approximately 47% of the Town's total commercial collection program. A summary of the Town's commercial accounts is provided in Exhibit B-1 below.

As defined by Town ordinance, multi-family properties consisting of six (6) or more units per lot are prescribed bulk commercial waste collection service. Furthermore, Town policies and practices for multi-family customers are designed to assume one (1) bulk container per every 25 housing units. Collection from these containers is provided by the Town at a minimum of once per week at no cost. Additional weekly collection events for any container are scheduled and provided in accordance with the Town's bulk container collection fee schedule, based on the container size and frequency of collection. Collections from these multi-family properties are performed by the Town's Commercial operations utilizing front loader trucks.

The Town ordinance does allow for special waivers granted by the Town Manager or Town Council. Waivers are considered for units constructed before 1973, when this ordinance was promulgated, and for properties where bulk service would create a public safety or health concern.

When the Town discontinued side loading collection services for multi-family properties a number of waivers were also granted for properties that could not reasonably accommodate front loading service. As a result, these waivers present collection scenarios where similar properties receive different collection services, and some of these multi-family property owners have requested to have a choice in the type of service offered (i.e., that residential roll-cart service be provided).

Exhibit B-1. Commercial Collection by Account Type

Commercial Account Type	Collection Frequency (x per week)	Container Size, Cubic Yards 2	4	6	8	Total (CY/Week)
		Number of Accounts				
BUSINESS (Total)		**4**	**72**	**102**	**1,568**	**1,746**
	1	4	56	36	504	600
	2	-	16	48	560	624
	3	-	-	18	312	330
	4	-	-	-	192	192
BUSINESS,RESTAURANT (Total)		**-**	**-**	**-**	**64**	**64**
	4	-	-	-	64	64
GOVERNMENT (Total)		**-**	**-**	**-**	**72**	**72**
	1	-	-	-	8	8
	2	-	-	-	64	64
MULTI-FAMILY GOVERNMENT (Total)		**-**	**-**	**-**	**32**	**32**
	1	-	-	-	16	16
	2	-	-	-	16	16
MULTI-FAMILY (Total)		**-**	**-**	**42**	**2,784**	**2,826**
	1	-	-	42	1,384	1,426
	2	-	-	-	1,216	1,216
	3	-	-	-	24	24
	4	-	-	-	160	160
RESTAURANT (Total)		**-**	**-**	**24**	**432**	**456**
	1	-	-	12	48	60
	2	-	-	12	144	156
	3	-	-	-	72	72
	4	-	-	-	128	128
	5	-	-	-	40	40
SCHOOL (Total)		**-**	**-**	**18**	**824**	**842**
	1	-	-	18	24	42
	2	-	-	-	32	32
	3	-	-	-	768	768
Grand Total		**4**	**72**	**186**	**5,776**	**6,038**

Multi-Family Allocation based on collection volume capacity	47%	
Theoretical collection capacity calculation:		
Disposal Capacity, cy/week	6,038	cy/week
	52	weeks
Disposal Capacity, cy/year	313,976	cy/year
Density (lbs/cy)	300	lbs/cy
Disposal Capacity, tons	47,096	tons/year
Projected Commercial Collection FY 2013, tons/year	8,590	tons/year
Utilization factor	18%	

Note: Commercial Account Type names are taken directly from Town's database.

To make the eligibility criteria for the waiver process more consistent, we recommend that specific standards be established for approving future requests. We believe the eligibility criteria for multi-family properties requesting residential roll-cart service should include:

1. All units have frontage on a public street that is constructed to Town standards; and,

2. All units have driveways or other clearly defined curbside locations where roll-carts can be serviced along the public street from behind the curb without blocking sidewalks for each individual unit.

If these eligibility criteria are accepted, we believe that two existing multi-family properties that have previously requested roll-cart service may now be granted waivers. These properties are Vineyard Square with 191 units and Franklin Grove with 41 units, for a total of 232 units.

MULTI-FAMILY COLLECTION SERVICES FINANCIAL EVALUATION

Residential Roll-Cart Collection and Disposal Cost

As presented in Section 7 of this Study, SCS calculated the Town's per household cost for residential waste collection and disposal on a per roll-cart basis. Based on the Town budget, SCS allocated costs between residential and commercial collection services as consistently established throughout this Study. Also as described in this Study, the Town represents 11,500 households as reported by census data and other public demographic reports. The unit cost for residential roll-cart collection service which includes all residential solid waste services (e.g., yard waste collection, bulky item collection, weekly trash collection, etc.), assuming one (1) 64-gallon roll-cart per household with collections twice per week for MSW and yard waste is estimated $16.60 per month per household:

Allocated Residential Collection Cost/ # of Households

$$\left(\frac{\$2{,}290{,}238\ allocated\ \ annual\ residential\ collection\ \ cost}{11{,}500\ households}\right) = \$119.15\ year\ \ per\ Household$$

$$\left(\frac{\$119.15\ annual\ cost\ \ per\ household}{12\ months}\right) = \$16.60\ month\ \ per\ Household$$

$$\left(\frac{\$2{,}290{,}238\ allocated\ \ annual\ residential\ collection\ \ cost}{9{,}750\ tons\ \ per\ \ year}\right) = \$234.90\ \ per\ ton$$

Commercial Bulk Container Collection and Disposal Cost

As described in Appendix A of this Study, SCS allocated the Town's solid waste collection and disposal costs into Residential and Commercial programs based on staffing and equipment assignments. From this point the Commercial collections program was further subdivided into Commercial Multi-Family and Commercial Business accounts based on the Town's list of

commercial accounts. These analyses estimated collection and disposal costs of $402,400 per year may be allocated to the commercial multi-family service. Based on the Town's chart of accounts, this analysis identified 265 bulk containers serving the Town's multi-family developments. This equates to a cost of $126.50 per month/per container.

Allocated Multi-Family Collection Cost/ # of Bulk Containers

$$\left(\frac{\$402{,}400\ allocated\ \ annual\ multi-family\ collection\ \cos t}{265\ bulk\ containers}\right) = \$1{,}518\ year\ \ per\ bulk\ container$$

$$\left(\frac{\$1{,}518\ annual\ \cos t\ \ per\ bulk\ container}{12\ months}\right) = \$126.50\ month\ \ per\ bulk\ container$$

$$\left(\frac{\$126.50\ allocated\ \ annual\ multi-family\ collection\ \cos t}{T\arg eted\ \ 25\ households}\right) = \$5.06\ month\ \ per\ Household$$

Break-Even Household Utilization

By comparing the monthly cost for the Town to provide bulk container service versus the unit cost for residential roll-cart service, this financial analysis concludes the break-even point at which it becomes more cost-efficient to provide bulk container service is estimated 7.6 households. Notably this is reasonably consistent with the current Town ordinance.

Bulk Container Cost/ Unit Roll-Cart Cost

$$\left(\frac{\$126.50\ bulk\ container\ \cos t}{\$16.60\ unit\ roll-cart\ \cos t\ \ per\ household}\right) = 7.6\ households\ \ per\ bulk\ container$$

BULK CONTAINER UTILIZATION ANALYSIS

While this analysis concludes that 7.6 households is the break-even point at which bulk container service becomes more efficient than residential roll-cart collections, certainly cost-efficiencies may be gained by serving additional households for each bulk container. The Town's practices designed to provide service for 25 households per container appears reasonable and may even be lowered.

Chapel Hill Data

For each 8 cubic yard bulk container, assuming a lose density of 300 pounds per cy, equates to an estimated maximum capacity of 2,400 pounds per container. Based on our analysis of the utilization of the Town's commercial waste service, SCS estimated that 18% of the Town's commercial collection capacity is being used; therefore, each 8 cubic yard container may contain only 432 pounds of waste during an average week.

From historical disposal records, the Town disposes approximately 6,780 tons of residential MSW per year. Assuming 11,500 residential households, this equates to 1,179 pounds of MSW per Household per year, or 22.68 pounds per week. Using these data, SCS projects that approximately 19 households may be serviced by a single 8 cubic yard bulk container per week.

Utilized Container Capacity (pounds)/Household MSW Generation (pounds)

$$\left(\frac{432\ lb\ container\ capacity}{22.68\ lbs\ per\ household\ per\ week}\right) = 19.04\ households\ per\ week$$

RECOMMENDATIONS

Based on this limited evaluation of the Town's multi-family waste collection and disposal service, SCS makes the following recommendations.

Town Ordinance Modifications

Revise the Town ordinance to include additional eligibility criteria for multi-family property owners requesting special waivers for residential roll-cart waste collection service. These additional criteria should include:

1. All units have frontage on a public street that is constructed to Town standards; and,

2. All units have driveways or other clearly defined curbside locations where roll-carts can be serviced along the public street from behind the curb without blocking sidewalks for each individual unit.

Bulk Container Target Utilization

Based on industry statistics, SCS believes the Town's current practice of allocating one 8 cubic yard dumpster to a target of 25 households is reasonable.