Guide to Developing Community Solid Waste Facilities:

Citizens Collection Stations & Small Transfer Stations

Fall 1999

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I. EXECUTIVE SUMMARY

The Texas Strategic Plan for fiscal years 1999-2003 states that the average Texan disposes of 6.23 pounds of municipal solid waste per day. The average disposal rate in the H-GAC 13-county region is 6.15 pounds per person per day and the H-GAC regional population continues to grow at 1.99% per year. This increase is constantly increasing the need for ways to properly dispose of solid waste in the region. Although large landfill capacity exists on a statewide basis, several regions of the state do not have conveniently located disposal sites. The closure of 4,165 landfills across the state has left many areas with an illegal dumping problem.

While many governmental entities within the region have implemented environmental enforcement programs, few have offered their citizens legal disposal sites. When a landfill is not available within 25 miles of the center of a service area, communities need to provide a site for residents to dispose of bulky items, special waste, and household waste.

H-GAC provides its members with many documents to assist in evaluating illegal dumping costs and solutions. This workbook provides an opportunity to evaluate the addition of a service to the community that is likely to decrease illegal dumping and its associated costs. A recent study commissioned by the Houston-Galveston Area Council (H-GAC) found that counties must pay between $2 and $3 per resident, per year, to clean up illegal dumps and to enforce solid waste laws. This workbook addresses the options available to governments for solid waste collection and disposal. Since the closure of most government operated landfills in the early 1990's, these entities have been struggling with controlling the costs and availability of waste services, and in determining what type of facility would best serve their constituents.

Most governments are limited in the resources they have to fund solid waste programs. This workbook will demonstrate how to estimate the total costs of the existing solid waste system. It will also show how alternatives such as a citizens collection station (CCS) or transfer station may lower their cost-per-capita spent on solid waste activities. These alternative solutions can also be used to offset costs of illegal dumping.

At their most basic levels, CCSs are simply conveniently located places where residents can drop off their trash at certain times of the day. These stations typically feature one or more moveable trailers, dumpsters, or roll-off bins to temporarily store and then transport the collected waste to a municipal solid waste landfill. Transfer stations are a more advanced mechanism for areas with larger daily volumes being transported more than 25 miles one-way for disposal. A transfer station is a facility where waste is collected and then transferred to a disposal site. Typically collection vehicles unload on an elevated tipping floor above open top transfer trailers that are loaded in the lower level tunnel area. Sometimes the waste is unloaded from the collection vehicle through a hopper directly into a transfer trailer. Other designs require the use of heavy equipment to push the waste into the transfer trailer below.

The purpose of this document is to assist local governments in developing inexpensive community solid waste facilities, particularly CCSs and transfer stations. This workbook will address issues faced by governments in determining their needs, planning a facility, evaluating regulatory requirements, constructing the new facility and operating it. The workbook is intended to be used by solid waste managers, policy makers, and community decision makers who have a general knowledge of the solid waste system in their community. The intention is to assist these people in determining if it is beneficial to expand their existing solid waste management system to include a CCS or a transfer station.

Dannenbaum Environmental Corporation (DEC) was retained by H-GAC to develop this workbook which helps rural communities evaluate their existing solid waste system and determine whether a CCS and/or transfer station would enhance that system. While most solid waste infrastructure systems would be enhanced with the addition of CCSs and transfer stations, this workbook provides a quantitative means of evaluating demographics, effectiveness of the existing solid waste infrastructure and enhancement costs.

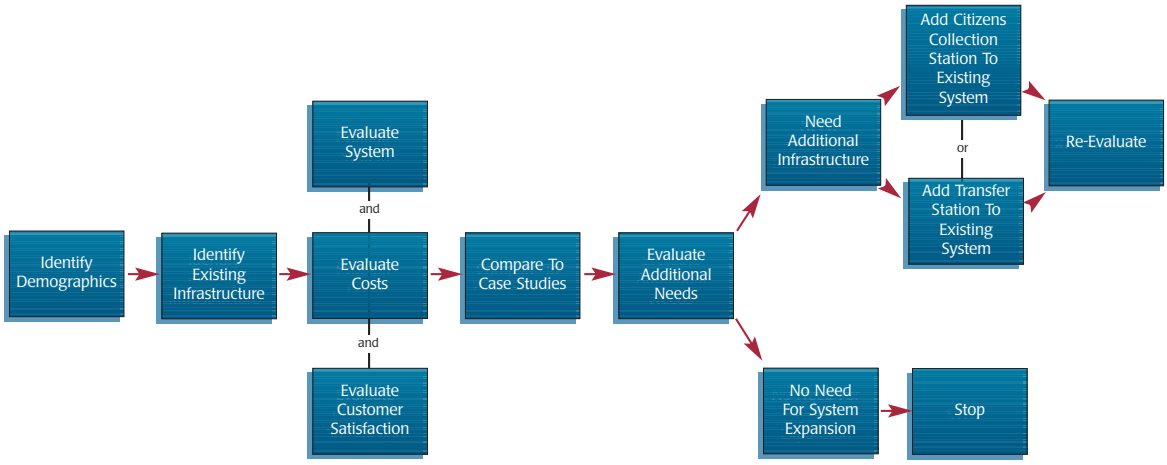
This workbook is developed as a guideline for government agencies to evaluate their own system. The evaluation should be for the purpose of determining whether the existing system is adequately serving the solid waste needs of the population, or whether alternative infrastructure mechanisms are necessary.

The workbook will focus on the implementation of CCSs and transfer stations because these are the most economically viable solutions for smaller communities. Other alternatives exist, and will be mentioned, but will not be evaluated for economic feasibility. Communities should work with their neighboring communities to develop programs and implement systems. A transfer station could be a joint venture used to serve several cities or counties. This would reduce the cost-per-capita in an area, while maintaining control of the solid waste services.

This report is formatted such that "Section I. Executive Summary" provides a brief summary of the case studies, the test evaluation, and the worksheets provided. "Section II. Introduction" provides an overview of the document layout and purpose. "Section III. Case Studies" gives the reader an in-depth look at three solid waste infrastructure systems that are adequately serving their communities, Chambers County, the City of Huntsville, and Matagorda County. Each of these case studies provides a different perspective on ways to utilize available technologies, depending on the specific needs and resources available. The case studies provide demographic information such as population, service area, waste generation, and waste streams handled by each community. Existing solid waste infrastructure is discussed with regards to illegal dumping and clean-up programs, reduction, reuse, and recycling programs, collection services, and disposal options. The effectiveness of each system is evaluated from several perspectives including public opinion and a thorough discussion of all associated costs.

"Section IV. Solid Waste Infrastructure Evaluation" provides the reader with an overall comparison of the three case studies and allows the reader to compare their system with the case studies. Section IV provides a step-by-step method for the reader to evaluate their existing system on a cost-per-capita basis. The worksheets that will be used to evaluate the system can be found in "Section V. Evaluation Worksheets." The evaluation performed by DEC of Montgomery County is found in "Section VI. Montgomery County Evaluation." This evaluation gives an example of how the reader should proceed in evaluating his or her own system. "Appendix 2" provides the reader with reference materials. Some of these materials were used in the preparation of this workbook, while others are provided for the reader to learn more about CCSs and transfer stations. "Appendix 3" contains material referenced in the Matagorda County case study.

Evaluation Process Flow Chart



In an effort to demonstrate the types of projects that qualify for grant funding, this workbook includes the H-GAC logo in locations were a project that was funded by an H-GAC grant is discussed.

Acknowledgements

This manual was made possible through funding provided by the TNRCC and direction provided by H-GAC. A special note of thanks is due to the solid waste staffs of Chambers, Matagorda, and Montgomery Counties and the City of Huntsville.

DEC would like to thank those who provided information for this workbook, and especially Cheryl Mergo of H-GAC for her exceptional responsiveness to requests for information. The following persons served as resources for the case studies and test case:

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Community Recycling Group	Nancy Goodwin	409-291-0634
Matagorda County	Ed Schulze	409-244-2717
City of Bay City	Lisa Dibbern	409-245-9183
Montgomery County	Jim Strong	409-539-7812 or 281-353-9791
Montgomery County	Ron Wyatt	409-539-7819 or 281-689-3161
Montgomery County	Kenneth Hayden	409-539-7819 or 281-689-3161
Montgomery County	Precinct 3	409-539-7817 or 281-367-3977
Montgomery Central Appraisal District	Steve Compton	409-441-2186
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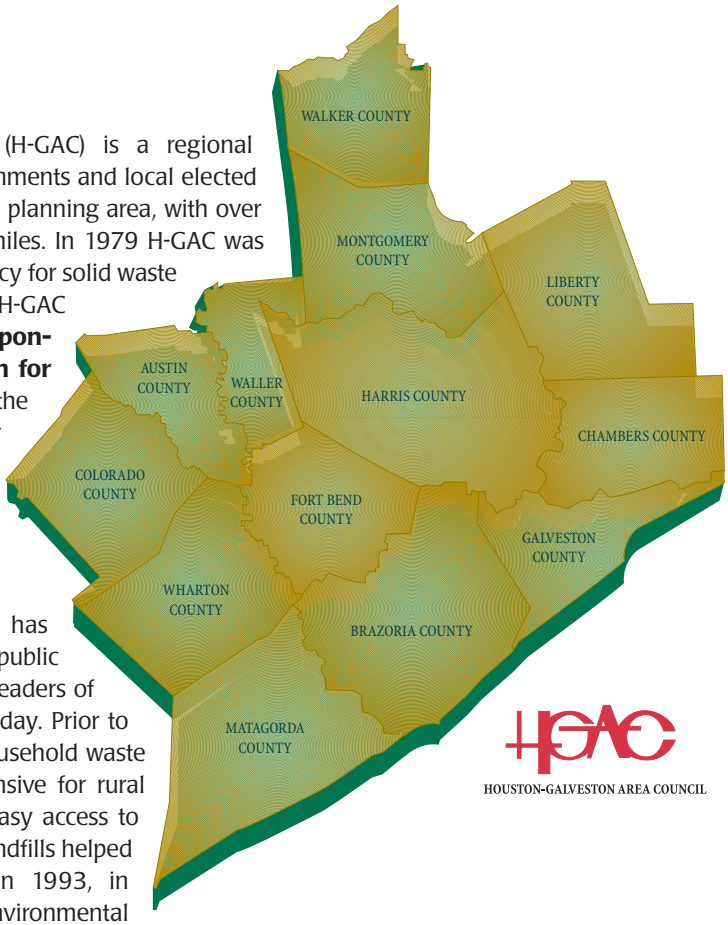
Republic Waste Services	Jeff Hobby	713-849-8416
The Woodlands Operating Co., L.P.	Fred LeBlanc	281-719-6121

Special thanks are due to all for their helpful comments and assistance in refining the format and content of this workbook.

II. INTRODUCTION

H-GAC Solid Waste Planning



The Houston-Galveston Area Council (H-GAC) is a regional voluntary association of 148 local governments and local elected officials serving the 13-county Gulf Coast planning area, with over 4.3 million people and 12,500 square miles. In 1979 H-GAC was designated as the regional planning agency for solid waste management in the Gulf Coast region. H-GAC has implemented **The Resource Responsibility Solid Waste Management Plan for the H-GAC Region, 1992-2012**, under the rules and procedures of the Texas Water Commission. The regional plan sets forth solid waste goals for the region. This workbook is intended to assist governments in carrying out these goals.

Illegal dumping of household waste has become one of the most challenging public health and safety problems confronting leaders of Texas rural counties and communities today. Prior to the 1990s, collection and disposal of household waste had been fairly convenient and inexpensive for rural communities because most areas had easy access to landfills and competition among those landfills helped to keep tipping fees low. However, in 1993, in response to rising public health and environmental concerns surrounding inappropriate landfill operations, the U.S. Environmental Protection Agency promulgated regulations for the safe design, operation and closure of municipal solid waste landfills. The directives set forth in the 1994 amendments to Subtitle D of the Resource Conservation and Recovery Act (RCRA) proved to be too costly for many rural area landfills, forcing many operations to close. Not surprisingly, as the rural landfills closed, municipal solid waste (MSW) disposal became less convenient and more expensive for rural residents, resulting in increased illegal dumping in Texas and throughout the country.

Purpose

The purpose of this document is to assist local governments in developing inexpensive community solid waste facilities, particularly CCSs and transfer stations. This workbook will address issues faced by governments in determining their needs, planning a facility, evaluating regulatory requirements, constructing the new facility, and operating it. The workbook is intended to be used by solid waste managers, policy makers, and community decision makers who have a general knowledge of the solid waste system in their community. The intention is to assist these people in determining if it would be beneficial to expand their existing solid waste management system to include a CCS or a transfer station. Depending on the level of data collection, staff support and public involvement that is used, the CCS or transfer station planning process should take between three and twelve months to complete.

A glossary of terms is provided in Appendix 1 to assist readers of this document. Definitions are either extracted from the Texas Municipal Solid Waste (MSW) regulations (30 TAC 330) or are industry-accepted meanings.

Scope

The Texas Strategic Plan for fiscal years 1999-2003 states that the average Texan disposes of 6.23 pounds of municipal solid waste per day. The average disposal rate in the H-GAC 13-county region is 6.15 pounds per person, per day, and the H-GAC regional population continues to grow at 1.99% per year. This increase is constantly increasing the need for ways to properly dispose of solid waste in the region. Although large landfill capacity exists on a statewide basis, several regions of the state do not have conveniently located disposal sites. The closure of 4,165 landfills across the state has left many areas with an illegal dumping problem.

While many governmental entities within the region have implemented environmental enforcement programs, few have offered their citizens legal disposal sites. When a landfill is not available within 25 miles of the center of a service area, communities need to provide a site for residents to dispose of bulky items, special waste, and household waste. Otherwise, residents are likely to illegally dump along roadsides and in ditches.

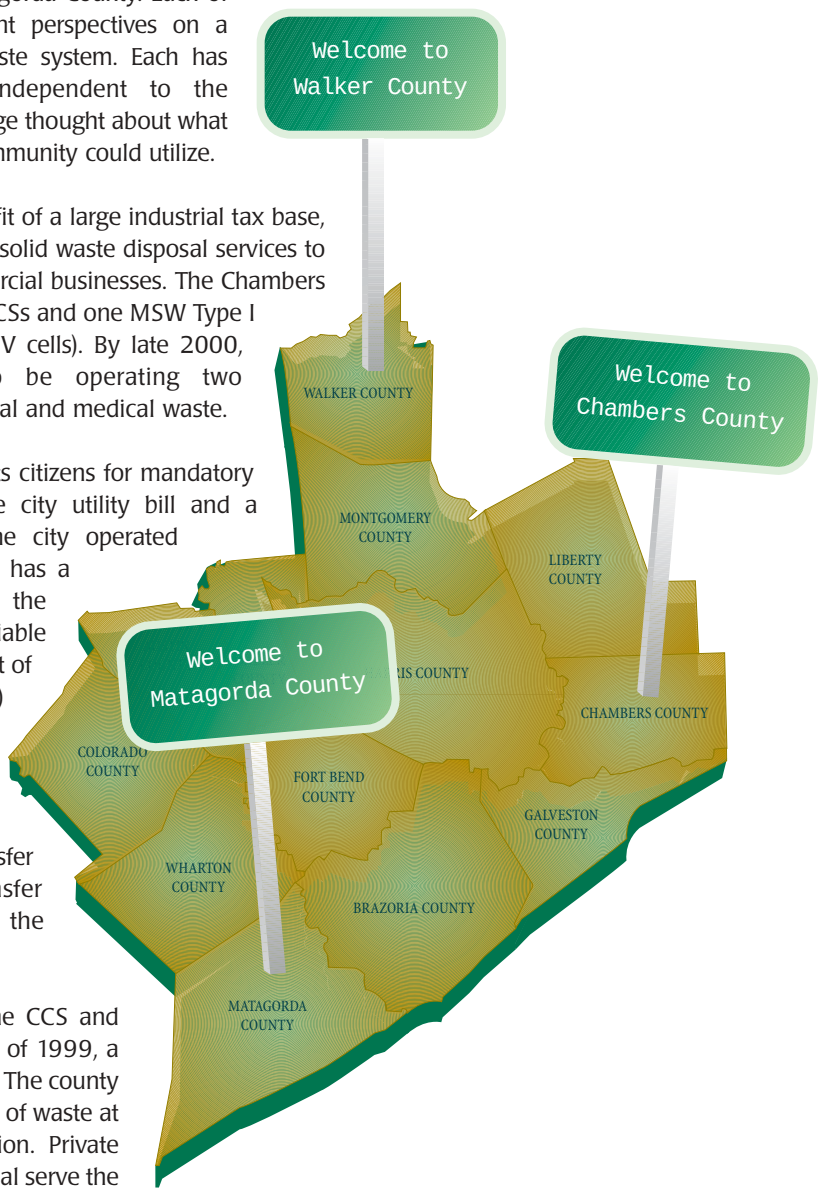
H-GAC provides its members with many documents to assist in evaluating illegal dumping costs and solutions. This workbook helps communities evaluate a new service that is likely to decrease illegal dumping and its associated costs. A recent study commissioned by H-GAC found that counties must pay between $2 and $3 per resident, per year, to clean up illegal dumps and to enforce solid waste laws. This workbook addresses the options available to governments for solid waste collection and disposal. Since the closure of most government operated landfills in the early 1990's, these entities have been struggling with controlling the costs and availability of waste services, and in determining what type of facility would best serve their constituents.

Most governments have limited resources to fund solid waste programs. This workbook will demonstrate how to estimate the total cost of the existing solid waste system. It will also show how alternatives such as a CCS or transfer station may lower their cost-per-capita spent on solid waste activities. These alternative solutions can also be used to offset costs resulting from illegal dumping. In addition, millions of dollars in grant funds are available for solid waste projects that assist in implementation of the regional plan and in achieving H-GAC regional solid waste goals.

Recycling activities are also addressed in this workbook. While there has been an increase in the number of recycling programs in the region, additional infrastructure mechanisms to reach the recycling goal of 40% by the year 2002 are needed. Although recycling activities are typically an added expense for governments, they are very popular programs. Different types of recycling activities are addressed and the costs associated with these activities are discussed.

Study Area

The three case study locations are Chambers County, the City of Huntsville, and Matagorda County. Each of these cases offer very different perspectives on a government operated solid waste system. Each has unique features that are independent to the community and should encourage thought about what unique features the reader's community could utilize.



Chambers County has the benefit of a large industrial tax base, which allows them to offer free solid waste disposal services to all county residents and commercial businesses. The Chambers County system includes eight CCSs and one MSW Type I landfill (with Type I and Type IV cells). By late 2000, Chambers County will also be operating two incinerators that accept municipal and medical waste.

The City of Huntsville charges its citizens for mandatory collection services through the city utility bill and a disposal fee is charged at the city operated transfer station. Huntsville also has a unique financial situation with the state prison system as a reliable customer. The Texas Department of Criminal Justice (TDCJ) transports its waste to the Huntsville transfer station. The revenue generated from TDCJ disposal funds 18.39% of the operational costs of the transfer station. The Huntsville transfer station also serves most of the citizens of Walker County.

Matagorda County operates one CCS and one transfer station. By the end of 1999, a second CCS will be in operation. The county charges the same fee to dispose of waste at the CCS and the transfer station. Private haulers for collection and disposal serve the citizens of the incorporated cities in Matagorda County (Bay City and Palacios). Although the option is available to large private haulers, currently none of this waste is taken to the county transfer station.

The key to success in the case study examples lies in making the waste collection service as convenient and affordable as possible in order to entice would-be dumpers back into compliance with state and county waste disposal laws.

Montgomery County, where there are currently no solid waste services offered by the county, served as our test case. Montgomery County has a severe illegal dumping problem and hopes to begin combating it by providing services to its community. This study evaluates their options and makes recommendations for improving their existing system.

Process

Dannenbaum Environmental Corporation (DEC) was retained by H-GAC to develop this workbook which assists rural communities evaluate their existing solid waste systems and determine whether a CCS and/or transfer station would enhance that system. While most solid waste infrastructure systems would be enhanced with the addition of CCSs and transfer stations, this workbook provides a quantitative means of evaluating demographics, effectiveness of the existing solid waste infrastructure, and enhancement costs.

Three in-depth case study evaluations were performed of regional systems (chosen by H-GAC) that are serving their communities well. After the case study information was evaluated and compared, worksheets were developed to use in evaluating a rural community's need for additional solid waste infrastructure systems, specifically CCSs and transfer stations. An analysis was then performed using Montgomery County. The worksheets were revised as needed during this evaluation to better utilize readily available information and serve the needs of governmental officials who would be using the workbook. All parties who participated in providing information for the workbook, H-GAC, and the TNRCC reviewed the final draft document. Comments were addressed and the final document was presented to H-GAC for final approval.

This workbook is developed as a guideline for government agencies to use when evaluating their own system. The evaluation should be for the purpose of determining whether the existing system is adequately serving the solid waste needs of the population, or whether alternative infrastructure mechanisms are needed.

The workbook will focus on the implementation of CCSs and transfer stations because these are the most economically viable solutions for small communities. Other alternatives exist, and will be mentioned, but will not be evaluated for economic feasibility. Communities should work with their neighboring communities to develop programs and implement systems. A transfer station could be a joint venture used to serve several cities or counties. This would reduce the cost-per- capita in an area, while maintaining control of the solid waste services.

Document Outline

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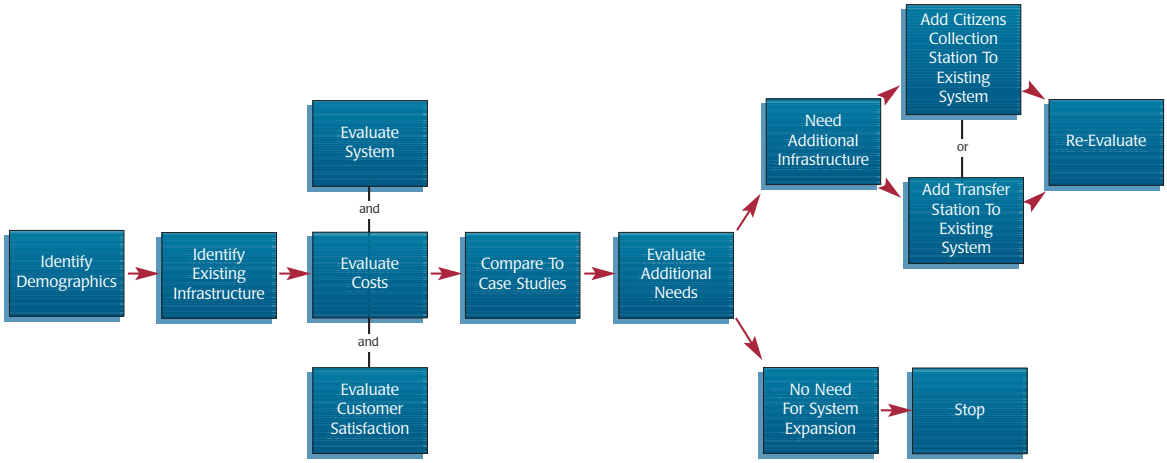
Evaluation Process Flow Chart



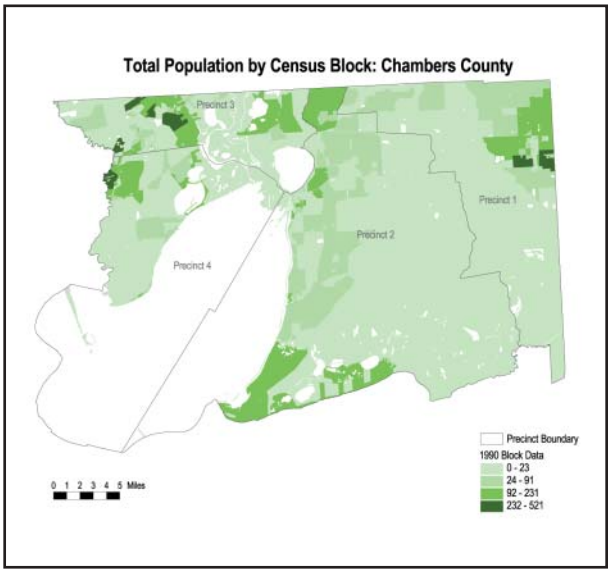
Solid waste professionals refer to volumes of waste in terms of cubic yards and tonnage. When discussing the case studies, DEC maintained the volume reference utilized by the city or county. The comparisons of these case studies are shown in both units, using the TNRCC annual reporting conversion factors of:

Uncompacted cubic yards	***x***	***0.2***	***=***	***tons***
Compacted cubic yards	***x***	***0.333***	***=***	***tons***

III. CASE STUDIES

Chambers County Case Study

Study Area Description



Chambers County has a long history of providing solid waste services. They began operating CCSs twenty years ago. At that time collection stations were merely a green box located near a populated area. There were up to twenty of these locations at any given time. As the population grew, higher capacity collection stations became necessary. Larger stations required moving farther from populated areas due to nuisance concerns. Eventually the number of collection stations decreased and new larger stations were added. (Some of the collection stations are now located at landfills that closed due to Subtitle D.)

Currently Chambers County operates eight CCSs and one MSW Type I landfill (with Type I and Type IV cells). By mid 2000, the county will also be operating two incinerators that will be capable of accepting up to 50 tons per day of municipal and medical waste. The county does not offer any transportation or home collection services to its residents or businesses. However, a majority of citizens are serviced by small commercial haulers, their city's municipal hauling, or a large private hauler.

A unique feature of Chambers County's system is that all disposal is essentially free to both residents and commercial businesses located in the county limits. Residents are required to purchase a $2 permit that allows them to use the CCSs and landfill. Commercial haulers are required to purchase a $10 commercial hauler agreement. Their copy of this agreement allows them the same privileges as residents. The permit system is used to prevent use of the county facilities by non-county residents. Chambers County is able to provide these services at no cost because of their large industrial tax base.

Chambers County accepts out-of-county waste at its landfill for a fee. They charge $6.15 per cubic yard for compacted waste and $5.50 per cubic yard for loose waste. Commercial haulers generally use this service. Out-of-county waste is only a small portion of the incoming receipts at the landfill, typically only 200-300 cubic yards per month.

Chambers County does not handle recycling of residential products. The most populated area (the western portion of the county) has a partnership program with Exxon in place to recycle standard household products.

Chambers County does ask that its citizens separate the waste they bring to the CCSs in the following categories: Type I Waste, Type IV Waste, Brush, Pallets, White Goods, Used Oil, Used Oil Filters, Batteries, and Tires. Separation of Type I and Type IV waste has allowed them to divert a substantial amount of waste from the Type I cells at their landfill, thereby conserving landfill space and synthetic liner construction costs. Brush is chipped and redistributed to citizens as requested. Pallets and white goods are recycled for a small profit. Used oil and oil filters are sent to recycling facilities. Tires are disposed of through the H-GAC tire program.

Population

The population of Chambers County is approximately 25,000. The county is 5% urban and 95% rural. The average density is 33 people per square mile. Although they currently have eight CCSs, their population is quickly outgrowing the existing capacity. Chambers County's population is growing at a rate of 2.33% per year. Population growth data is shown in Table 1. Chambers County, Texas is located near Houston and borders the Gulf of Mexico. The western third of the county, near Baytown, is heavily industrial including an oil refinery and tire burning facility. The eastern section of the county is rural with dryland rice farming, commercial fishing, and retail businesses. Over one half (55%) of Chambers County residents commute to the Houston area to work. Most of the county is comprised of single-family detached homes.

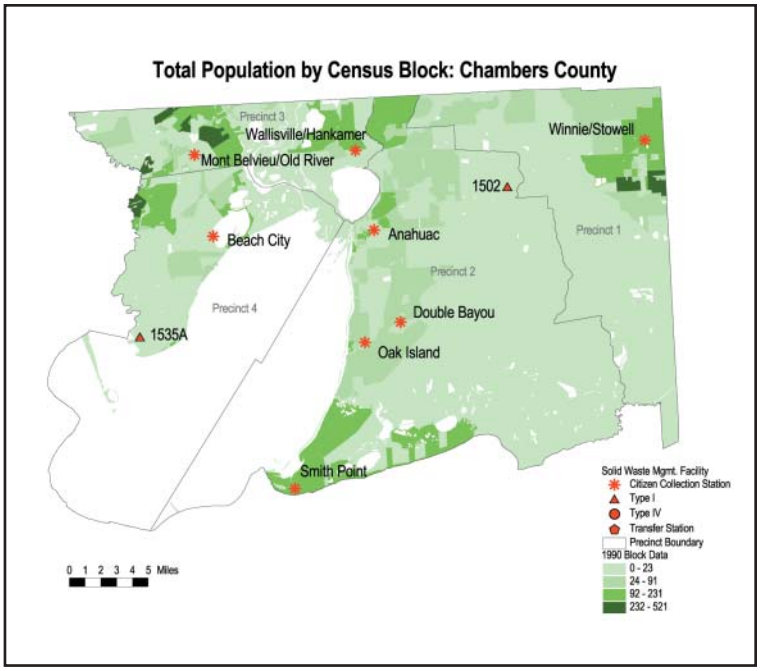


Table 1: Chambers County Expected Population

(Source: "A Study of Solid Waste Composition, Chambers County, TX" by Rigo and Rigo Associates)

Year	Population
1990	20,088
1995	22,531
2000	25,271
2005	28,345
2010	31,793
2015	35,660
2020	40,000

Service Area

Chambers County has CCSs located in areas convenient to all portions of the county. They do not charge any county residents or businesses for disposal at the landfill or the CCSs, nor do they charge a fee to any municipal or commercial hauler who brings waste to any of their facilities (as long as the waste is generated within the county). The tax base in the county is large enough to support the solid waste operations without additional expense to residents at the gates. Each citizen is required to obtain a window sticker for disposal privileges. The sticker is good for two years and costs $2. Each commercial hauler is required to obtain a commercial hauler agreement, good for one year, at an expense of $10. In addition to MSW disposal, each sticker allows for disposal of up to four passenger tires per year. Each additional passenger tire costs $1 to dispose.

Waste Generation

Table 2 demonstrates the amount of municipal solid waste collected annually at the eight CCSs and landfill in Chambers County.

Table 2: Municipal Solid Waste Collected In Chambers County Annually

(Source: Jimmy Kahla, Director of Solid Waste, Chambers County)

Collection Site	Compacted Waste (cubic yards)	Non-Compacted Waste (cubic yards)	Used Oil (gallons)	Oil Filters (55 gallon drums)	Tires
Belton Lane	1,960	11,930	2,220	1	1,788
Beach City	4,400	18,770	3,396	-	2,580
Eagle Drive	4,520	19,190	3,840	-	2,724
Smith Point	-	5,670	948	-	492
Wallisville	1,260	7,590	1,224	1	2,640
Winnie	6,040	19,050	2,664	2	2,784
Double Bayou	-	3,046	-	-	1,260
Oak Island	-	4,750	948	-	972
Landfill	14,206	17,188	2,712	23	2,208
Total Collected	**32,386**	**107,184**	**17,952**	**27**	**17,748**

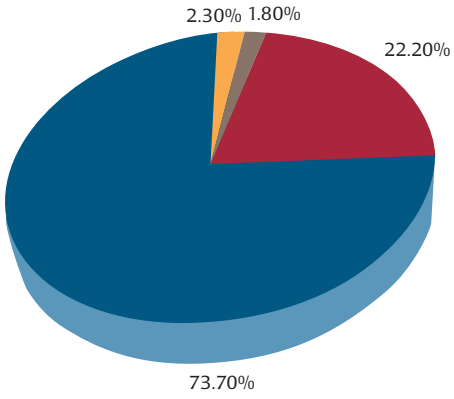
Waste Stream

The waste stream in Chambers County is made up of Type I and Type IV MSW, brush, tires, white goods, used batteries, used oil, and used oil filters. Type I and Type IV waste are separated at the CCSs and transported separately to the landfill, where they are disposed of in separate cells. Brush is also separated at the CCSs and the landfill and stockpiled until it can be chipped. The wood chips are transported at no charge to the citizens in the area of the collection stations. Currently, demand for the wood chips exceeds the supply. White goods are also diverted at the CCSs and recycled. Tires are recycled through H-GAC's tire program with Waste Recovery and used oil and oil filters are recycled through O'Rourke Petroleum. Used car batteries are recycled through Energy Battery, however the CCSs have a problem with batteries being stolen since they can be easily recycled for a profit. Percentages and amounts of waste in the waste stream are shown in Figure 1.

Figure 1 - Chambers County Waste Stream Content by Percentage and Cubic Yards

(Source: Jimmy Kahla, Director of Solid Waste, Chambers County, with the exception of asterixed column)

Disposal Type	Cubic Yards Generated	*Percentage of Total Waste
Compacted	32,386	22.20
Non-Compacted	107,184	73.70
Wood Chips	3,336	2.30
White Goods	2,551	1.80
Combined Yearly Total	**145,457**	**100.00**



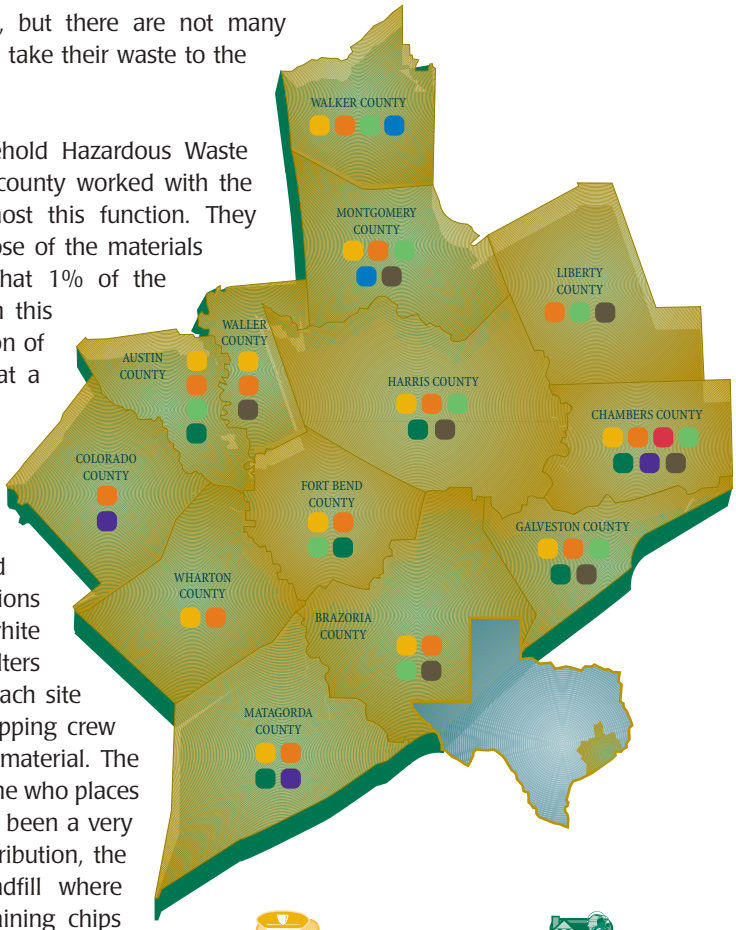
Solid Waste Infrastructure

Illegal Dumping and Clean-Up Programs

Because disposal is essentially free, there are very few illegal dumping problems in Chambers County. When a disposal site is found, it is typically tires because people do not want to pay the additional $1 to dispose of them. Chambers County believes that staffing their CCSs ensures that citizens separate their waste properly, controls potential illegal dumping, and controls the cleanliness of the station. Before all sites were manned, the county would frequently find trash laying on the ground at the CCSs, and waste separation was not performed properly.

Burning is legal in Chambers County, but there are not many instances of it because people prefer to take their waste to the CCSs or the landfill.

Chambers County held its first Household Hazardous Waste Collection day on June 5, 1999. The county worked with the cities of Baytown and Pearland to host this function. They contracted with Philip Services to dispose of the materials collected. Based on an expectation that 1% of the county population would participate in this event, the county budgeted for collection of 3,750 to 5,000 pounds of materials at a disposal cost of $30,000.



Reduction, Reuse, and Recycling Programs

Chambers County has established several innovative ways to recycle portions of their waste stream. Brush, tires, white goods, batteries, and used oil and oil filters are all recycled. Brush is gathered at each site (eight CCSs and the landfill) and a chipping crew circulates among the sites to chip the material. The wood chips are then distributed to anyone who places their name on the waiting list. This has been a very successful program. Prior to public distribution, the chips were being hauled to the landfill where people could pick them up and remaining chips were landfilled. Since transportation of the chips has become a public service, the demand far exceeds the supply. The county is also saving money on time and transportation because chips are delivered to people in the area of the CCSs instead of being hauled back to the landfill. The only problem with their existing wood chipping operation is that it is time consuming. The chipper they own requires a two-man crew and is labor intensive. H-GAC Grant

The local school districts have partnered with Exxon to recycle in the schools. Champion Paper had established a paper-recycling program, but withdrew it when they determined there wasn't enough paper generation in the county. However, the county offices and the schools recycle office paper, H-GAC Grant aluminum and aseptic packaging. Curbside recycling is not available in the county at this time.

White goods are collected for metal recycling at the CCSs and the landfill. Removal of the Chloro Fluoro Carbons (CFCs) and recycling of the scrap metal was previously handled by an outside company, but the county was able to find a more cost-effective way to recycle these products. A solid waste employee, trained in CFC removal, prepares the items for recycling. Once all necessary materials are removed, the metal is sent to a scrap-metal recycler.

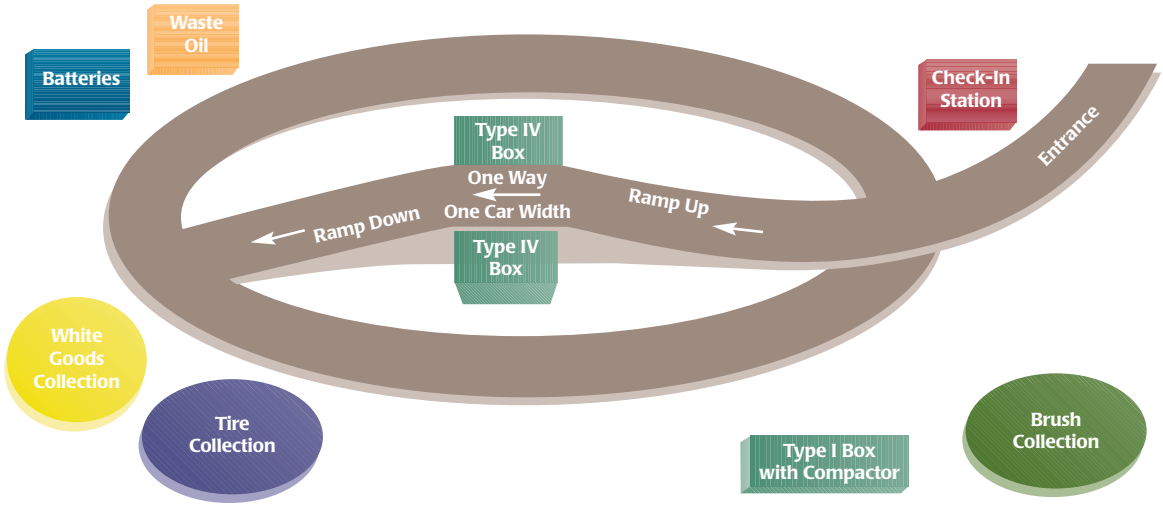
Collection - Hauling, Transfer Stations, Citizens Collection Stations

The county operates eight manned CCSs which accept municipal waste, Type IV waste, used oil, used oil filters, tires, brush for grinding, white goods, and batteries. These items are also collected at the landfill owned and operated by the county. By mid 2000, the county will also be operating two incinerators that will be able to accept medical waste as well as municipal waste. The ash from the incinerator will be placed in the landfill.

Chambers County Citizens Collection Station

Chambers County has operated CCSs for almost twenty years. Initially, CCSs were in approximately twenty locations and they were only 8-yard boxes. It was very expensive to maintain this system. Eventually they decreased the number of CCSs and increased the collection box size to 40-yard boxes. Now, sites have compactor stations, roll-off boxes, or both. Sites with both use the compactor stations for MSW and the roll-off boxes for Type IV waste. The waste is trucked from CCSs to the landfill by county owned roll-off vehicles and county employees. A typical Chambers County CCS layout is shown as Figure 2.

Figure 2: Typical Chambers County Citizens Collection Station Layout



CCSs are sited with the following criteria in mind:

- Adjacent to populated areas
- Not immediately adjacent to residences
- Awareness of odor and cleanliness issues
- Awareness of wet weather issues
- Awareness of potential leachate runoff issues

The CCSs are staffed and are open 6 days a week, from 9:00 a.m. to 6:00 p.m. The landfill is open 5 days a week from 8:00 a.m. to 3:30 p.m. The incinerators will be in operation 7 days a week.

Commercial collection needs in the county are handled through private contracts. These private haulers are allowed to use the county's landfill at no charge for waste originating in Chambers County.

Disposal - Landfilling, Incineration

When Subtitle D requirements became effective, Chambers County decided to keep their landfill open because they had the financial resources to support the new requirements and they wanted to maintain control of their waste services. A study was performed to determine the proposed costs involved with keeping the landfill open. The projections were much higher than the actual costs have been. However, the operating cost has increased significantly from $660,000 per year to $1.5 million per year. The future incinerators were proposed and accepted during this time period. In July of 1998, the county completed construction of its first Subtitle D lined cell. The existing landfill property is approximately 400 acres, and they own an additional 400 acres across the street. Of this, 88.3 acres are permitted for disposal. As of March 1999, approximately 20 permitted acres remain un-constructed. With the incinerators factored in, the county expects to have an additional 70 years of life remaining in the currently permitted landfill.

Recently the county re-permitted several of its Type I cells to Type IV cells. They operate two separate working faces at the landfill, one for Type I and one for Type IV. This allows them to conserve resources by not constructing synthetic liner systems and leachate collection systems under the Type IV areas. When they initiated separation of Type I and Type IV materials at the CCSs, they were surprised at the large volume of materials that were diverted as Type IV. Since the county began this requirement, they have discovered that 70% of the waste collected is Type IV waste. They highly recommend that other solid waste entities evaluate their waste streams and divert this material to a C&D site, rather than a MSW site.

Small commercial haulers dispose of waste at the landfill for free anytime, however they are only allowed to dispose of waste at specified CCSs. This depends on the county commissioner in the area, who determines whether small commercial haulers are allowed to dispose of waste at their local CCS. The reason the small commercial haulers would not be allowed to use the CCS is because it takes them much longer to unload their waste than residents. At busier collection stations residents may have to wait 30 minutes to unload behind a small commercial hauler.

BFI and Waste Management both dispose of waste at the Type I landfill at no charge since they collect waste within the county. The cities of Anahuac and Mt. Belvieu both have their own municipal collection services and don't pay for disposal of waste at the Chambers County landfill.

Chambers County chose to expand their solid waste infrastructure to include incinerators because it is environmentally safer and it would offset the cost of increasing expenses tied to landfill operations. The county owns a lot of land and could easily expand, but the permitting process is expensive. The incinerator did not create any opposition from the public. They believe their public approval stems from free disposal, resulting in citizens who support cost effective disposal of solid waste. Incineration offers this cost-effective solution to Chambers County.

Construction of the incinerator is projected to begin in July 1999, with completion approximately one year later. The incinerator will accept municipal and medical waste. Disposal will continue to be free for all municipal waste originating in the county. The county hopes that the income generated from disposal of medical waste will offset the costs involved in designing, constructing and operating the incinerator. Chambers County has already begun marketing their future medical waste disposal services. The county will continue to operate its landfill and plans to dispose of their incinerator ash in the landfill.

Although things are currently operated on a yardage basis, the incinerator will have scales and will weigh all incoming waste. They believe that this will allow for better data collection and control of their system. They also believe that weighing their waste rather than measuring box sizes will decrease their TNRCC tipping fees because the measurement will be more accurate.

Regulatory Requirements

Chambers County maintains several permits and registrations with the TNRCC due to their extensive solid waste management activities. The Type I MSW landfill is permitted with the TNRCC under permit number 1502. Closed portions of the landfill hold the TNRCC permit number 1013. The incinerator is being constructed under TNRCC permit number 2239. In accordance with MSW regulations, Chambers County has also registered each of its CCSs, tire collection sites, and waste oil collection sites with the TNRCC.

System Effectiveness

Chambers County officials believe that staying in the solid waste business was a wise decision because it allows them to control costs of services provided to citizens. The only other alternative would have been private hauling and disposal. They believe that there are too many unknowns in private hauling and disposal options. They believe that competition is decreasing among the private haulers and they can not predict the future costs involved with private operations.

Public Opinion

Generally the public is very happy with the existing solid waste infrastructure system. The CCSs are well-maintained, centrally located, and easy to use. However, the time spent waiting at the collection stations is rapidly increasing. The rapid growth in population in Chambers County has caused the commissioners to evaluate whether the small commercial haulers should be allowed to use the collection stations. Citizens are finding that the small commercial haulers, who spend a long time unloading their trailers, are crowding the collection stations. The citizens who have come to drop off a bag or two of garbage have to wait for these small commercial haulers to unload. Slowly, the small commercial haulers are being forced to haul to the landfill instead of the CCSs, which is greatly increasing their hauling costs. This will eventually increase competition because the large private companies would have the opportunity to compete with the small commercial haulers.

Costs

Chambers County has placed a high priority on maintaining its solid waste department as a free service to its citizens. The 1998 and 1999 annual budgets for the existing infrastructure system are shown in Table 3. In addition, Chambers County is investing more than $10 million in the permitting, design, and construction of the new incinerators.

Table 3: Chambers County Solid Waste Operational Costs for 1998 (Actual) and 1999 (Budgeted)

(Source: Jimmy Kahla, Director of Solid Waste, Chambers County)

Item	1998 Actual	1999 Budget
Salaries	$ 530,541	$ 587,125
FICA	40,703	44,805
Retirement	39,592	49,541
Group Insurance	73,110	87,305
Total Personnel Cost	**683,946**	**768,776**
Miscellaneous Supplies	18,683	6,840
Gas and Oil	43,108	50,000
Uniform Service	5,834	5,500
Insurance and Bonds	3,000	3,000
Travel	4,135	800
Professional Fees	43,144	30,000
Equipment Rental	1,611	20,000
Radio Expense	0	8,159
Repair and Maintenance	59,222	34,000
Tire Disposal	0	8,000
Household Hazardous Waste	0	32,000
Facility Upgrade	411,679	30,000
Site Maintenance	36,972	30,000
Groundwater Monitoring	80,247	50,000
Methane Monitoring	9,608	20,000
TNRCC Fees	40,190	30,000
Total Operating Cost	**757,433**	**358,299**
Capital	12,395	45,000
		*($122,417)
Solid Waste Facility	2,991	0
Cell Construction	65,754	0
Equipment	56,882	0
Total Capital Cost	**138,022**	**45,000**
Total Solid Waste Cost	**$ 1,579,401**	**$ 1,172,075**

**Encumbrances/Expenditures to Budget Account FY1999.*

The solid waste department is funded through the large industrial and residential tax base. Chambers County has also been successful in obtaining H-GAC and TNRCC grant monies to fund their projects. Their main source of funding for special projects is through H-GAC.

Chambers County has recently installed a computer system called System Quest to assist in tracking their expenditures. This system will allow them to categorize and track exactly how much is being spent in each tracking category, at each CCS, at the landfill, etc.

Capital

Financing methods used by Chambers County are standard municipality financing options. Bonds are paying for the incinerators. Operation and maintenance costs for the CCSs are paid for out of the annual operating budgets. Special projects are funded through the county's Capital Improvement Process (CIP), allocating capital to the solid waste division for a special project.

Equipment

Procurement of vehicles has become a cost-saving event in Chambers County due to a program established with their dealer. Every year the county buys new trucks by trading in last year's vehicles. The trade-in value is pre-established as the original sale price of the vehicle. The only cost to Chambers County is the upgrade price between the two vehicles. The vehicles remain under full warranty throughout the year, so that there are no repair costs involved in the maintenance of these vehicles. Chambers County owns one bulldozer and one compactor for use at the landfill. The solid waste department maintains these vehicles with staff mechanics. Labor costs and operation and maintenance costs associated with these vehicles are discussed in the respective sections.

Table 4: Chambers County Capital Equipment Costs

(Source: Jimmy Kahla, Director of Solid Waste, Chambers County)

Asset	Yearly Capital Investment	
Chipper Truck - 2	$ 0	H-GAC Grant
Chipper - 2	0	H-GAC Grant
Roll Off Truck - 3	12,000	
Stationary Compactor	24,960	
Mechanic Truck	1,306	
Dump Truck (3)	6,432	
Tractor (2)	2,902	
Maintainer	2,264	
Trackhoe	17,386	
Bulldozer	13,445	
Total Annual Capital Investment	**$ 80,695**	

Chambers County uses stationary compactors at a majority of their CCSs. They highly recommend the use of these because the compactor reduces the volume of waste by approximately one half. This reduces the number of trips from the collection station to the disposal facility by the same ratio. Chambers County's experience has been that stationary compactors require very limited amounts of maintenance and are well worth the additional initial capital costs. Table 4 provides the capital equipment costs for Chambers County.

Labor

The county's solid waste department employs approximately 30 people at its landfill and CCSs. Six of the eight collection stations have an attendant on duty at all times. The two facilities located in the geographic center of the county share one employee. Because Chambers County does not charge for disposal at its collection stations, the employees are responsible for ensuring that all people using the CCS have a Chambers County disposal permit tag on their vehicle or a commercial hauler agreement and that the facility stays clean. These employees also ensure that the boxes are emptied as needed.

Chambers County's total man-hour costs for the CCSs in 1998 were $305,166 and $174,542 for the landfill. Figures 3 and 4 show percentage allocations and dollar amounts spent in 1998 for each operational function.

Figure 3: Chambers County 1998 CCS Man-Hour Costs and Allocations

(Source: Jimmy Kahla, Director of Solid Waste, Chambers County)

Asset	Man-Hour Costs Per Year	Percentage of Total Man-Hour Costs
Chipper Truck - 2	$ 19,728	6.47
Chipper - 2	19,728	6.47
Roll Off Truck - 3	89,592	29.38
Belton Lane CCS	22,015	7.21
Beach City CCS	22,015	7.21
Double Bayou CCS	22,015	7.21
Eagle Drive CCS	22,015	7.21
Oak Island CCS	22,015	7.21
Smith Point CCS	22,015	7.21
Wallisville CCS	22,015	7.21
Winnie CCS	22,015	7.21
Total Man-Hour Annual Costs	**$ 305,168**	**100.00**

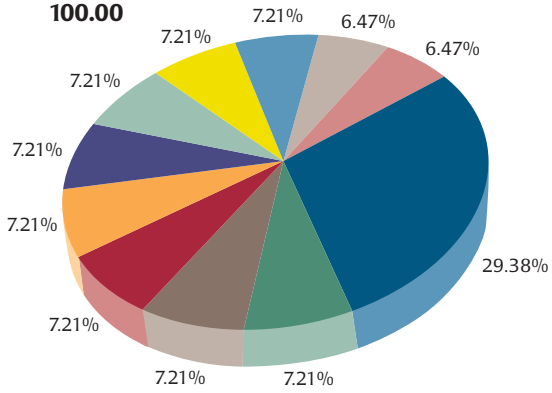
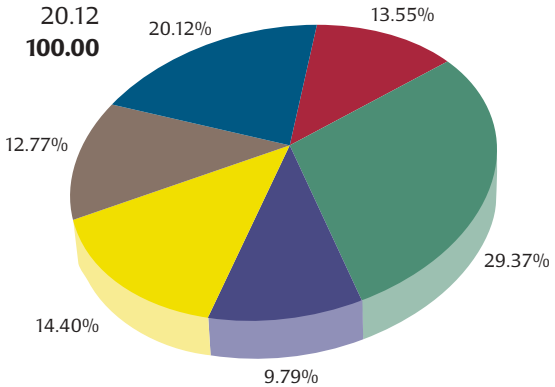


Figure 4: Chambers County 1998 Landfill Man-Hour Costs and Allocations

(Source: Jimmy Kahla, Director of Solid Waste, Chambers County)

Asset	Man-Hour Costs Per Year	Percentage of Total Man-Hour Costs
Mechanic Truck	$ 23,654	13.55
Dump Trucks (3)	51,264	29.37
Tractor	17,088	9.79
Dozer	25,127	14.40
Compactor	22,287	12.77
Maintainer & Trackhoe	35,121	20.12
Total Man-Hour Annual Costs	**$ 174,542**	**100.00**



Operations & Maintenance

Vehicle maintenance is provided by a mechanic employed by the solid waste department when not covered by the vehicle's warranty. The cost of maintaining the equipment, the fuel cost, and the cost to maintain each CCS is shown in Table 5.

Table 5: Chambers County Annual 1998 CCS Operations and Maintenance Costs

(Summarized from Jimmy Kahla, Director of Solid Waste, Chambers County)

Asset	Annual Maintenance Cost	Annual Fuel Cost	Total O&M Annual Cost	Percentage of Total Cost
Chipper Truck - 2	$ 1,493	$ 561	$ 2,054	4.8
Chipper - 2	6,816	135	6,951	16.3
Roll Off Truck - 3	13,202	6,527	19,729	46.2
Belton Lane CCS	6,113	0	6,113	14.3
Beach City CCS	1,033	0	1,033	2.4
Double Bayou CCS	846	0	846	2.0
Eagle Drive CCS	1,064	0	1,064	2.5
Oak Island CCS	1,832	0	1,832	4.3
Smith Point CCS	43	0	43	0.1
Wallisville CCS	1,581	0	1,581	3.7
Winnie CCS	1,448	0	1,448	3.4
Total O&M Annual Costs	**$ 35,471**	**$ 7,223**	**$ 42,694**	**100.0**

The cost of maintaining the equipment, the fuel cost, and the cost to maintain the landfill is shown in Table 6.

Table 6: Chambers County Annual 1998 Landfill Operations & Maintenance Costs

(Source: Jimmy Kahla, Director of Solid Waste, Chambers County – asterixed columns only)

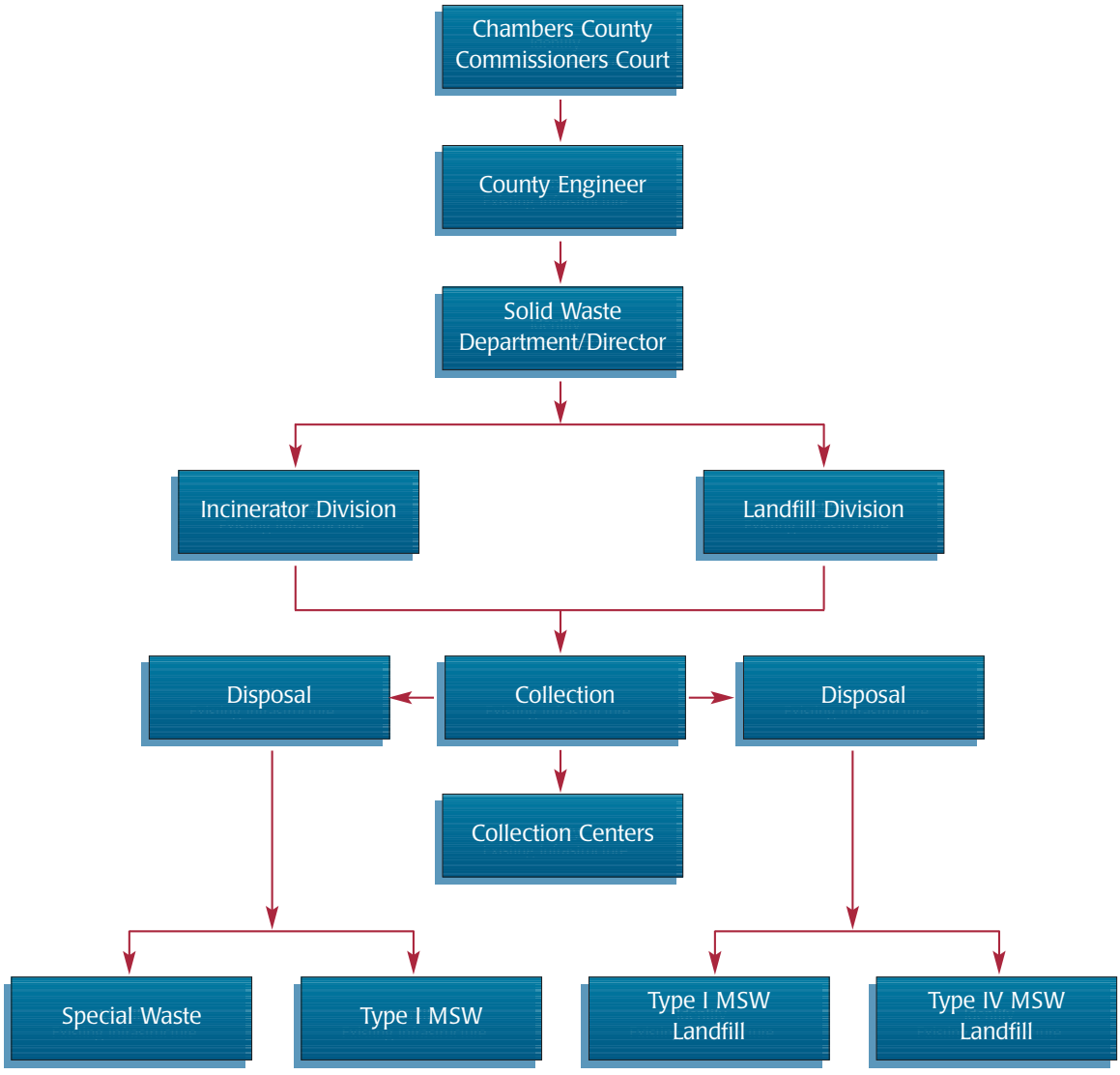
*Asset	*Annual Maintenance Cost	*Annual Fuel Cost	Total O&M Annual Cost	Percentage of Total Cost
Mechanic Truck	$ 807	$ 497	$ 1,304	4.5
Dump Trucks (3)	8,402	1,618	10,020	34.7
Tractor	844	400	1,244	4.3
Dozer	349	4,431	4,780	16.6
Compactor	4,577	2,426	7,003	24.2
Maintainer	1,002	482	1,484	5.2
Trackhoe	973	2,060	3,033	10.5
Total Operations & Maintenance Annual Costs	**$ 16,954**	**$ 11,914**	**$ 28,868**	**100.0**

Chambers County must pay to dispose of the used oil and used oil filters collected at the CCSs and the landfill. The disposal fees for these materials in 1999 are $35 per 55-gallon drum of used oil filters and $100 per year for used oil. Tires cost $1.04 each to recycle through the H-GAC tire program.

Administration

Chambers County Solid Waste Department acts as its own entity within the county government. Jimmy Kahla serves as director of this department. Mr. Kahla reports to the County Engineer, who in turn reports to the Chambers County Commissioners Court. The organizational chart for the department is shown in Figure 5. A great strength of Chambers County's solid waste program is the commitment of an entire department devoted to its success.

Figure 5: Chambers County Solid Waste Department Organization Chart

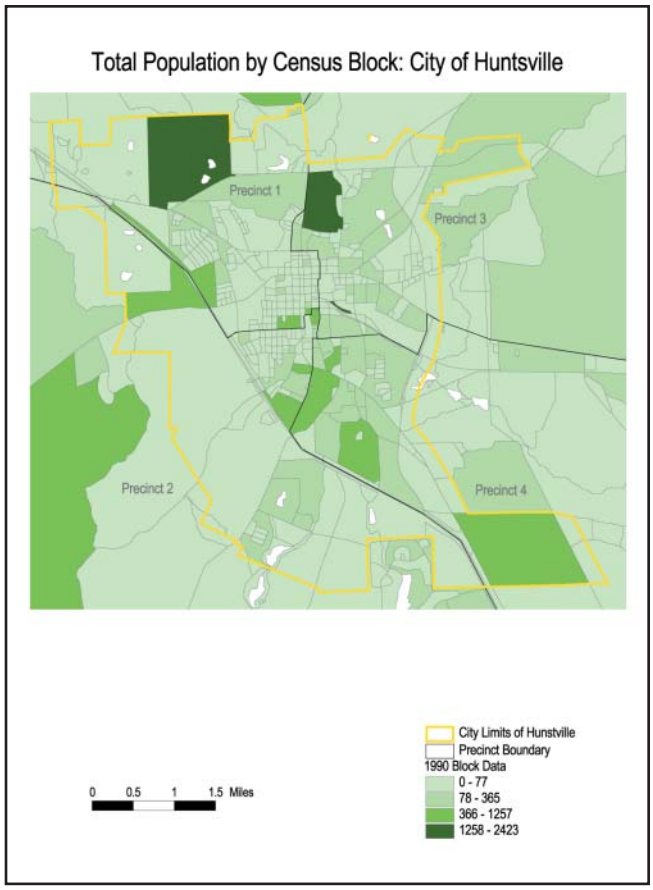


City of Huntsville Case Study

Study Area Description

The City of Huntsville's solid waste system includes collection and disposal for all residences and businesses inside the city boundaries, as well as businesses located two miles into the ETJ. Huntsville's system also offers roll-off boxes and dumpsters (sizes range from 2-yard to 30-yard) for customers.

Huntsville maintained a state approved sanitary landfill from 1973 to 1994. In 1994 the city constructed a transfer station adjacent to its closed landfill. Huntsville owns and operates its own transfer station. The transfer station allows residents from the city and Walker County to dispose of waste for a fee. Huntsville does not allow large private hauling companies to dispose of waste at its transfer station. Walker County, however, has a permitting process in place that requires all small commercial haulers to become permitted before they are allowed to dispose of waste at the transfer station.



Huntsville has a unique situation because the city limits include five units of the Texas Department of Criminal Justice (TDCJ) prison system and Sam Houston State University. The state prison system operates as its own separate entity, and does not depend upon Huntsville to provide services to the inmates. However, the inmates and the personnel that live on site at the units are included in the city's population count. Since the prison is self sufficient, its waste is handled exclusively by the prison system. They recycle approximately 50% of their waste stream through composting, food waste recovery, and recycling. The waste generated by all of the prison units in the vicinity of Huntsville (both inside and outside the city limits) are collected and transported by prison personnel to the Huntsville transfer station where they pay higher rates than local citizens to dispose their waste. For the purposes of this case study, the prison system will be removed from the Huntsville data to determine per capita disposal costs, because they operate as a completely separate entity. However, the income generated from this "customer" will be included in the total cost analysis because they bring their waste to the Huntsville transfer station.

Huntsville does not have a formal education program to inform people about the transfer station and the recycling center. However, Huntsville spends $5,000 per year on media promotions, and the city staff provides recycling presentations to civic organizations upon request. A representative from the sanitation department visits the local primary and secondary schools with a garbage truck and discusses disposal and recycling. In addition, Walker County provides illegal dumping education programs.

New Huntsville residents receive a packet of information that includes collection schedules and fees, as well as general collection and disposal information. Huntsville has a large transient population due to the local university. These students are typically educated on the disposal procedures through the university housing or their apartment complex.

Huntsville sanitation department employees are educated on waste classifications and materials that are not allowed to be disposed of at a municipal solid waste landfill. The only issue that has ever arisen has been related to medical waste because the city collects the municipal waste from the local hospital. The city's transfer station does not accept medical waste, but they do accept the municipal waste from the medical facility.

Population

The population of Huntsville is approximately 34,592. The total population includes portions of the TDCJ inmate population and groups that are not counted as Huntsville residents for census purposes. Although exact service area population is not known, these combined totals are thought to provide a reasonable estimate of the service area population. Table 7 provides City of Huntsville and ETJ population data and growth projections. The approximate TDCJ population within Huntsville's census count is 10,000. The TDCJ number includes employees housed on the prison grounds and prisoners. The TDCJ population will not be included in the case study analysis because they handle their waste as a separate waste stream.

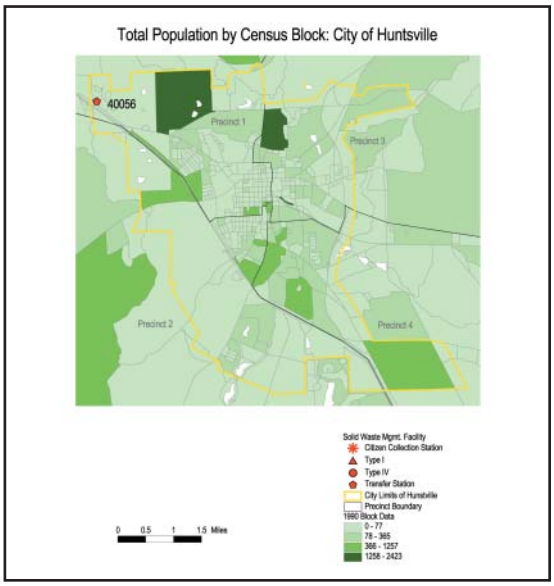


Table 7: City of Huntsville Population Growth and Projections

(Summarized from Final Report – Solid Waste Disposal Study: City of Huntsville, TX, March 1986)

Year	Total Within City	Estimated ETJ Population	Combined Total
1981	25,122	1,531	26,653
1985	26,964	1,900	28,864
1990	29,676	2,489	32,165
2000	33,716	3,734	37,450
2010	38,576	5,601	44,177
2020	44,446	8,402	52,848

Service Area

The area served by Huntsville's sanitation department includes all residential and commercial users within the city limits and commercial customers two miles into the ETJ. Businesses and residents within the city limits are required to contract with the city for their solid waste collection and disposal services.

Huntsville's residential collection services 6,429 pickup locations, including 310 commercial locations and 800 "back-door pick-ups". A back door pickup allows the citizens to leave their trashcans next to or behind their house, where the collector will retrieve the waste. The city limits the distance for "back-door" service to 75 feet in most cases. Exceptions are made for handicap and elderly citizens.

Huntsville's transfer station is the only legally operating disposal site in Walker County. Waste Management owns a greenfield permitted landfill site in Phelps (located 8 miles south of Huntsville), but it has never been operated. Citizens and small haulers from the entire county dispose of their waste at the transfer station, with the exception of those people residing in the New Waverly area. It is closer for these people to go to Waste Management's Security landfill, located in Montgomery County.

The waste generated by all of the prison units in the vicinity of Huntsville are collected and transported by prison personnel to the Huntsville transfer station where they pay to dispose their waste. For the purposes of this case study, the prison system will be removed from the Huntsville data to determine per capita disposal costs, because they operate as a completely separate entity. However, the income generated from this "customer" will be included in the total cost analysis because they bring their waste to the Huntsville transfer station.

Waste Generation

Huntsville's transfer station accepted 35,979 tons of waste in 1998. Since the transfer station accepts waste from Huntsville's collection service, TDCJ, permitted small commercial haulers, and local citizens who reside in the county, the transfer station acceptance volume does not represent only Huntsville's waste generation.

In March 1986, a solid waste disposal study was performed for the City of Huntsville. The per capita waste generation rate was calculated by dividing the tonnage measured in 1982 through 1985 by the total population served including residents, students, and inmates. These projections are shown in Table 8.

Table 8: City of Huntsville Solid Waste Projections

(Source: Final Report Solid Waste Disposal Study, March 1986)

Year	Population	Tons Per Person Per Year	Solid Waste Tons Per Year	Tons Per Day
1985	28,864	0.94	27,002	74
1990	32,165	0.96	30,878	85
2000	37,450	1.00	37,450	103
2010	44,177	1.04	45,944	126
2020	52,848	1.08	57,076	156

Waste is generated from several sources. These sources are shown with their total contributions to the waste stream in Table 9.

Table 9: Percentage Breakdown of Waste Receipts at Huntsville Transfer Station, Fiscal Year 1997-1998

(Summarized from City of Huntsville, TX, 1997-1998, Transfer Station Facility – Average Intake Tons Per Day)

Disposal Type	Total Tons	Percentage of Total
Commercial Route Collections	15,205	42.36
Residential Route Collections	6,511	18.10
Texas Department of Criminal Justice	6,612	18.37
Sam Houston State University	1,151	3.20
Licensed Local Haulers	777	2.16
City Resident Drop-Offs	1,267	3.52
Drop-Offs from Outside the City	4,457	12.39

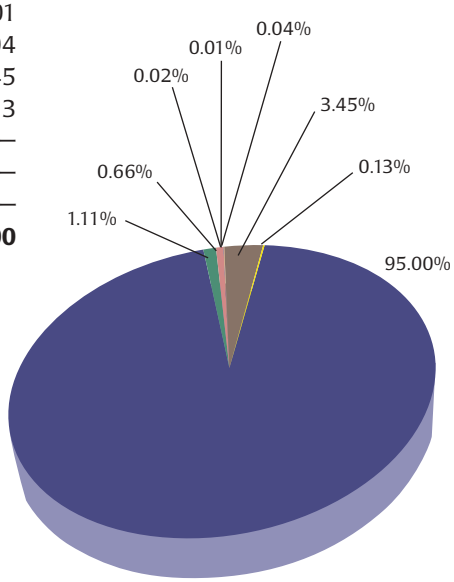
Waste Stream

The waste stream includes municipal solid waste as well as several items that are being diverted for recycling. These diverted items include white goods, pallets, tires, used oil and oil filters, antifreeze, aluminum, and brush. Huntsville also diverts concrete and road materials for reuse, but does not include these in their volume totals. Once a week yard waste is collected for composting. Materials at the transfer station are also diverted for composting. Waste stream volumes and percentages for Huntsville's transfer station intake are shown in Figure 6.

Figure 6: Waste Stream Volumes and Percentages of Intake at Huntsville's Transfer Station

(Summarized from City of Huntsville, TX, 1997-1998, Transfer Station Facility – Average Intake Tons Per Day)

Material	Volume (Tons)	Percentage
Municipal Solid Waste	34,022	95.00
Grit	399	1.11
TDCJ C&D Transfer	239	0.66
Wood Pallets	7	0.02
Christmas Trees	5	0.01
Tires	16	0.04
Yard Waste/Bulk Wood Waste	1,243	3.45
White Goods	48	0.13
Used Oil	1,080 gallons	–
Used Oil Filters	5-55 gallon drums	–
Used Coolant	2-30 gallon drums	–
Total	**35,979**	**100.00**



Solid Waste Infrastructure

Illegal Dumping and Clean-Up Programs

Huntsville does not have a formal illegal dumping program. The majority of the illegal dumping problems lie outside of city limits, and therefore are handled by Walker County. Walker County has had an Environmental Enforcement program in place for three years H-GAC Grant with an armed environmental enforcement officer presiding over the program. The initial actions of the program were to issue frequent citations to combat illegal dumping. As the program has become more apparent in the community, violations have decreased significantly. This is mainly because Walker County holds the originator of the illegally dumped waste responsible and charges them with a Class C misdemeanor.

Illegal dumping offenders have the opportunity to clean up their site as punishment if it is a small offense. If a large site is found, the offender is always prosecuted. The environmental officer has been very resourceful in finding other means of cleaning up the sites. County prison inmates or Gulf Coast Trade Center residents (teenagers) are frequently used. Disposal of cleanup materials occurs in a variety of ways. The municipal solid waste is either burned or taken to Huntsville's transfer station. Metals are recycled and the proceeds (generally $500-800 per year) are given to Walker County Proud in exchange for them paying any disposal costs incurred at the transfer station. Transportation of the waste simply occurs in the county pickup truck, which is equipped with a wench.

The environmental enforcement program has developed an educational program to complement the citations. Problem spots have been identified and the news media assists in publicizing the problem. Illegal dumping signs with a reporting phone number have been placed around the county (at a cost of $2.75 per sign). Two hundred fancier signs, which say "No Illegal Dumping in Walker County" have been posted as visible reminders of the problem. One hundred signs have been placed at rivers and creeks that say "Municipal Solid Waste Pollutes Drinking Water." Recently 8,000 flyers discouraging illegal dumping were printed and distributed through the schools and utility bills.

With the positive results of the enforcement officer's efforts, his duties have expanded beyond illegal dumping to include septic tanks, oil disposal, odor from livestock, and other environmental issues. Time will determine if this has a negative impact on the illegal dumping program.

Huntsville has one inspector who is designated as the environmental enforcement inspector through the health department. Huntsville handles complaint calls regarding illegal dumping through its city inspectors. The city inspector only receives two to three calls per month and these tend to be regarding illegal dumping into a business' dumpster. The standard procedure is to issue a warning to first time offenders if the violation is cleaned up, and a citation to repeat offenders. If an offender refuses to clean up the property, Huntsville will accept bids and pay for the property to be cleaned up, then issue a lien on the property in the amount of the clean-up effort. The average cost to clean a property is $1000, but the city rarely needs to take these steps. There were only 4 such instances in 1998. Funds used to clean up illegal dumpsites come from the inspection department's budget, rather than the solid waste budget.

Once a year Huntsville partners with Walker County and the non-profit group "Walker County Proud Communities" to host a "Trash Bash". The non-profit organization pays $3000 of the disposal costs. Huntsville and Walker County divide the remaining disposal costs. All citizens are allowed to dispose of their waste for free on this one day. It is used to encourage people to clean up the county. Small haulers are not allowed to use the transfer station during this clean-up day unless they pay the usual disposal fee.

Reduction, Reuse, and Recycling Programs

Huntsville has a very comprehensive recycling program. The program has two separate aspects: 1) diversion at the transfer station; and 2) a citizens recycling collection station. Diversion at the transfer station has been in place since the transfer station opened in 1994. Customers or the transfer station staff remove most large recyclable material from the waste stream prior to disposal. Drop-off at the recycling center does not cost the citizens, however, everything taken to the transfer station must be paid for except used oil, used oil filters, and antifreeze.

The transfer station diverted approximately 1,319 tons of material in 1998. These diverted items include white goods, pallets, tires, used oil and oil filters, antifreeze, aluminum, and brush. Huntsville also diverts concrete and road base materials, but they do not track volumes of these materials. Huntsville's Sanitation Superintendent has developed relationships with recyclers to handle most of these diverted materials. Huntsville makes no profit from recycling and, in fact, pays for disposal of such items as yard waste, oil, oil filters, antifreeze, and tires. White goods, pallets, aluminum, and brush are given to the recyclers (at no cost) in exchange for transportation and collection bins. The city stockpiles concrete, asphalt, and bricks for use as road base materials in municipal projects. While the transfer station is located on property adjacent to the permitted fill area of the closed landfill, the diversion area is located on closed fill areas.

Photos of Recycling Center

Huntsville maintains a citizens recycling collection station at a separate location. The recycling center was initiated by a group of local citizens, the "Citizens Community Recycling Group," and implemented by the Sanitation Department staff. The volunteer non-profit citizens group petitioned the City Council to initiate the program and helped in locating a nearby company willing to accept the recyclable materials. Huntsville contacted other companies and negotiated the final contract. The City of Huntsville provides the property for the site, an employee to operate the facility, and $5,000 per year for promotional ads on the local radio station and in the local newspaper. The volunteer group's greatest contribution was in having meetings that enabled city staff to correct popular misconceptions about the market value of recyclable materials, curbside recycling, effectiveness and cost of privatization. The citizens group also participated in the grand opening of the recycling center.

The city provides an employee to staff the facility 6 days a week, from 9:30 a.m. to 5:30 p.m. The recycling center has experienced very few instances of people leaving their recycles at the front gate when the facility is closed. A sign is posted at the recycling center, instructing people not to leave items when an attendant is not present. The recycling center employee is responsible for making sure containers are available to accept the recyclables and for getting the containers emptied. The employee is also responsible for ensuring that the recyclables are properly sorted. The center sorts into the following categories: clear glass, colored glass, #1 plastic, #2 plastic, aluminum, magazines, office paper, newspaper, cardboard, and steel. Data from 1998 shows that 677,705 pounds of material were recycled at Huntsville's recycling center.

The existing agreement with recycling collectors gives the recyclables to the collecting company in exchange for the containers to collect the recycles and transportation. For example, the company that takes the cardboard from the collection center provides the roll-off collection container that holds cardboard at the recycling center.

The recycling collection center is currently located at 595 Palm Street. It is just off of Sam Houston Avenue, housed on the grounds of and in the bottom of an elevated 2 million-gallon water tower. The tower was originally constructed to house city services, but has never been used for that purpose. Items that need to be kept dry, such as magazines and office paper, are collected inside the structure, while items that are not sensitive to weather conditions are collected outside. Citizens are drawn to the recycling center because of its central location and easy access, entering from one street and exiting onto another. The recycling center provides brochures to citizens that explain exactly what they take and any necessary preparation. There have been no surveys to determine if citizens would be interested in paying an additional fee to include a curbside recycling pick-up.

In addition to diversion at the transfer station, Huntsville operates a yard waste collection route one-day a week. The material that is collected on this route is hauled to a privately operated composting facility. The city pays the composting facility $10 per ton to take this material.

Collection - Hauling, Transfer Stations, and Citizens Collection Stations

Huntsville offers residential collection using manual residential collection garbage trucks with 3-man crews. Business collections occur through a contract in which Huntsville provides a collection bin at the business and empties it with a front-end collection vehicle. Residential waste collection occurs twice a week, on Monday and Thursday or Tuesday and Friday. Yard waste collection occurs on Wednesday. Monday and Tuesday are heavy collection and disposal days, while Thursday and Friday are significantly lighter.

City of Huntsville Collection Vehicles

Huntsville charges each residential customer $11.60 per month for twice weekly garbage collection and once a week yard waste collections. Of this $11.60, $9.28 covers solid waste expenses and 20%, or $2.32, covers the city's administrative costs. Commercial customers pay $15.20 per month for the same service or the fees shown in Tables 10 and 11 for roll-off service. The fees are collected through the city's existing billing system for other utilities (water, sewer, etc.).

Table 10: Fees for Collection Services Charged by Huntsville Inside the City Limits

(Source: City of Huntsville, TX, 1993 Council Resolution)

Service / Container	Fee Charged in Dollars
Collection at Apartments	$ 10.40 /unit*/month
Residential Twice Weekly Back Door or Curbside (includes once weekly yard waste collection)	11.60 /month
Commercial Twice Weekly Curbside (includes once weekly yard waste collection)	15.20 /month
2 yard box with weekly collection	30.40 /month
3 yard box with weekly collection	40.30 /month
4 yard box with weekly collection	50.20 /month
6 yard box with weekly collection	70.70 /month
8 yard box with weekly collection	89.20 /month
20 yard construction roll-off box	57.33 /collection
30 yard construction roll-off box	78.75 /collection
6 yard - 3-1 compaction with weekly collection	225.50 /month
Roll-Off Extra Dump (20 or 30 yard)	84.25
17 yard - 2.5-1 compaction per disposal	136.00
30 yard - 3-1 compaction per disposal	261.85
30 yard - 3.5-1 compaction per disposal	301.60
35 yard - 4-1 compaction per disposal	476.25
40 yard - 3.5-1 compaction per disposal	406.05
40 yard - 4-1 compaction per disposal	459.00
20 yard temporary/construction per disposal ($500.00 deposit, $75 setup fee, one disposal per month minimum)	167.30
30 yard temporary/construction per disposal ($500.00 deposit, $75 setup fee, one disposal per month minimum)	207.10

** Apartment owners can file a waiver with the city for months in which the units are vacant.*

Table 11: Fees for Collection Services Charged by Huntsville Outside the City Limits

(Source: City of Huntsville, TX, 1993 Council Resolution)

Service / Container	Fee Charged in Dollars
2 yard box with weekly collection	$ 48.80 /month
4 yard box with weekly collection	84.25 /month
6 yard box with weekly collection	120.70 /month
8 yard box with weekly collection	154.55 /month
20 yard construction roll-off box	411.65 /collection
30 yard construction roll-off box	587.60 /collection
Roll-Off Extra Disposal (20 or 30 yard)	142.60
20 yard temporary/construction per disposal ($500.00 deposit, $75 setup fee, one disposal per month minimum)	209.15
30 yard temporary/construction per disposal ($500.00 deposit, $75 setup fee, one disposal per month minimum)	258.85

Huntsville operates a transfer station on the property adjacent to its closed 127-acre landfill. The landfill facility opted to close due to Subtitle D regulations in 1993. The transfer station is located on property that was not within the permitted boundaries of the landfill, however the large amount of closed landfill area allows Huntsville to separate and store recyclable items.

Local citizens and Walker County permitted haulers are charged to dispose of waste at the transfer station. Only permitted commercial haulers are allowed to dispose at the transfer station. The transfer station is a manned facility that operates 6 days per week between 7:30 a.m. and 5:00 p.m. The transfer station has never had an illegal dumping problem at the gates. They believe this is due to the convenient operating hours of the facility and the visibility of the site. The transfer station entrance is off the feeder road of a major thoroughfare, I-45.

City of Huntsville Transfer Station

City of Huntsville Collection Station at the Transfer Station

City of Huntsville Transfer Station

The transfer station building is 9000 square feet and was designed to handle 250 tons per day of waste. Currently the facility receives an average of 180 tons on Mondays, 131 tons on Tuesdays, 100 tons on Wednesdays and Thursdays, and 134 tons on Fridays.

Since the transfer station has a steady flow of large truck traffic, Huntsville maintains a CCS on-site for all citizens and small commercial haulers to use. This enhances safety for both the citizens and the large trucks.

Revenue is generated through fees at the transfer station, as shown in Table 12. Citizens and small commercial haulers pay $4 per cubic yard for disposal at the transfer station. The TDCJ is the only customer that pays for its disposal by the ton. They are charged $53.22 per ton for disposal of MSW and $28.48 per ton for TDCJ to haul their own construction debris to the landfill under Huntsville's contract.

Table 12: Gate Fees Charged at the Huntsville Transfer Station for Disposal

(Source: City of Huntsville, TX, 1993 Council Resolution)

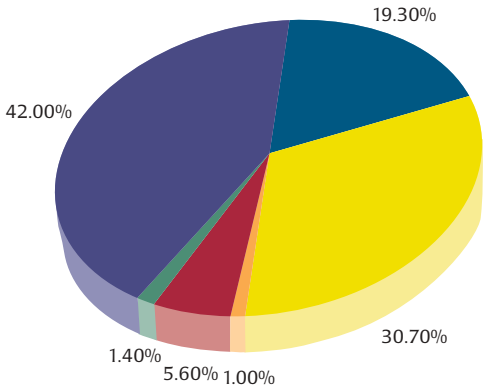
User	Fee in Dollars
Texas Department of Criminal Justice	$ 53.22 /ton for MSW disposal
Texas Department of Criminal Justice	28.48 /ton for TDCJ to haul their own construction debris to landfill under Huntsville's contract
Loose MSW	4.00 /cubic yard (minimum fee is $4)
White Goods/Large Furniture	4.00
Passenger Tires	1.00 /tire
Large Tires	12.00 /tire
Large dead animal (cow, horse, etc.)	30.00
Small dead animal (cat, dog, etc.)	3.00
Compacting vehicles	4.00 times manufacturer's capacity of truck times the manufacturer's compaction ratio
Trees, stump, and limbs over 4" in diameter	25.00 + $4.00/cubic yard

The majority of revenues for the sanitation department are generated through collection activities. The breakdown of revenues is shown in Figure 7. Total Revenues expected in FY 1998-99 is $2,879,730.

Figure 7: Huntsville's Projected Revenues by Source for Fiscal Year 1998-1999

(Source: "City of Huntsville, TX, Fiscal Year 1998-1999, Annual Budget")

	Percentage
Solid Waste Disposal	19.30
Residential Collection	30.70
Service Fee	1.00
Issue of Debt	5.60
Interest Income	1.40
Commercial Collection	42.00
Total	**100.00**



The income is divided between the city general fund and the sanitation department general fund prior to any expenses being paid. A 20% fee is paid to the city general fund to cover vehicle maintenance, the city's general overhead, billing, secretarial services, and the city administrative salaries. The remaining 80% of income goes into the sanitation department fund to pay the expenses of the department (salaries, operations and maintenance, capital expenses, etc).

Huntsville's sanitation department has encouraged the county politicians to consider CCSs. The Sanitation Department foresees a problem in the near future that will require collection locations in the county. The addition of an Environmental Enforcement Officer in Walker County has increased the number of people being charged for illegal dumping, but the county is not offering additional locations for residents to legally dispose of their waste.

Disposal - Landfilling, Incineration

Huntsville operated its own landfill until 1993 when it closed due to the upcoming Subtitle D regulations. The closed landfill facility does not require a significant amount of maintenance, since it is exempt from environmental monitoring. Huntsville has initiated a cost effective cover maintenance program. The city leases the closed landfill property to a local individual to grow hay. Both parties find this to be a lucrative situation because the property is being leased and Huntsville doesn't have to maintain the vegetative cover on the closed landfill.

Currently Huntsville transports waste from its transfer station to a Subtitle D landfill. Until October 1, 1998 the waste was being transported to Waste Management's Security Landfill located in Montgomery County. The disposal contract expired and the City Council opted to begin disposing of the waste at the Brazos Valley Solid Waste Management Agency's landfill. This decision was not based solely on cost, but also on the importance of governmental entities being more stable in today's market than a private organization. Even though the disposal fee increased $0.48 per ton and the mileage increased 23 miles per round trip, the additional cost is balanced by having the joint governmental entities cooperate on the use of a municipal landfill. There has not been a rate increase to Huntsville's citizens or at its transfer station since 1993, but the city is expected to increase the fees it charges to cover these added expenses within the next couple of years.

Regulatory Requirements

Huntsville maintains TNRCC permit number 0196 for it's closed landfill facility. Their transfer station is registered with the TNRCC, since they meet the exemptions for permitting under the 30 TAC 330 regulations. The transfer station's registration number is 40056. Huntsville also has registrations with the TNRCC for its tire collection and used oil collection practices. The recycling collection center did not require any TNRCC solid waste permitting or registration. However, it did require that they receive approval from the TNRCC water division because it is located at the site of a water tower.

System Effectiveness

Huntsville's program has been very effective. The city has utilized their closed landfill location and was able to move the landfill employees into similar positions at the transfer station. Huntsville has been able to maintain their collection and disposal services without significant increases in rates to citizens. A key reason for the effectiveness of their system is that one department focuses solely on solid waste issues.

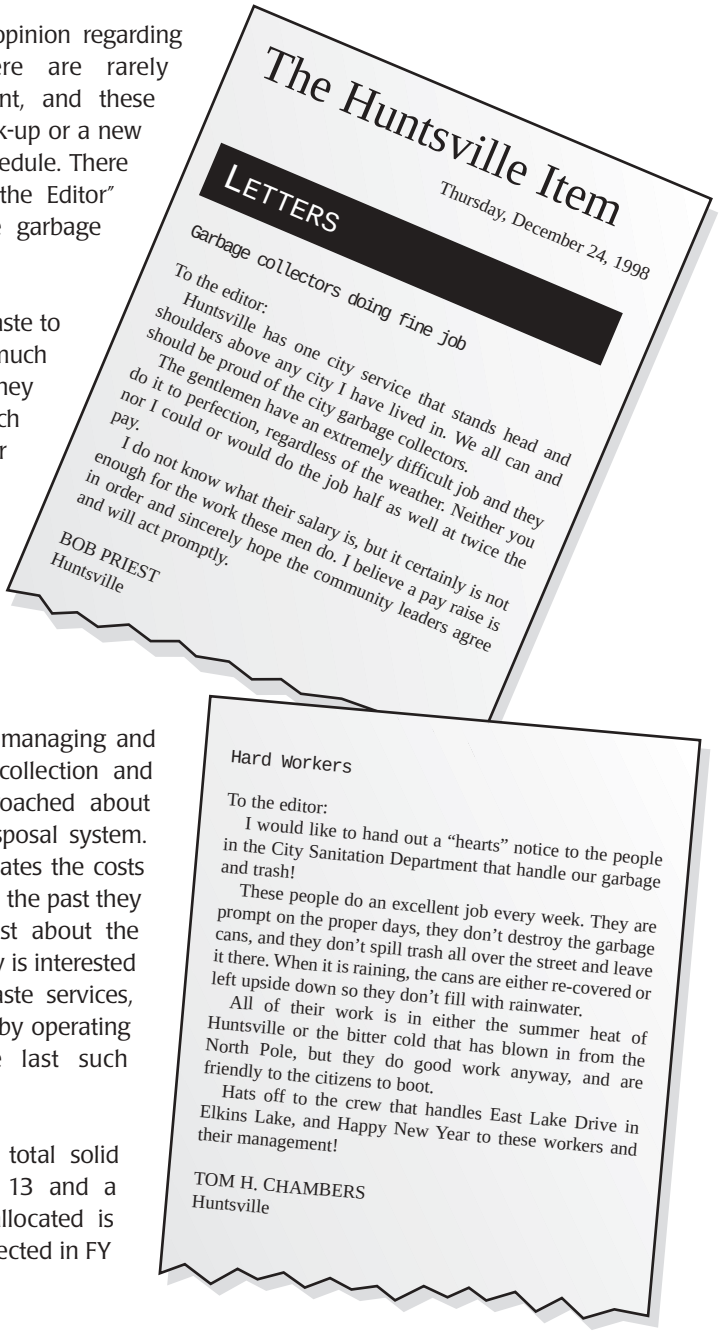
Employees of the sanitation department tend to be long-term employees and they are generally very satisfied with their jobs. The residential drivers are paid on a "task pay" system, where each 3-man crew serves approximately 800 customers per day. These employees tend to work 30 hours a week, and get paid for 40 hours due to efficiencies they have developed in their jobs.

Safety has not been a problem for Huntsville. Employees attend regular safety meetings and signs are posted at all facilities encouraging safe practices by employees and the general public. There have rarely even been traffic problems with the collection trucks on their routes. The transfer station offers a CCS for citizens to use, while the large trucks use the tipping floor in the transfer station. Transfer station employees empty the CCS roll-off boxes on a regular basis. Once the transfer trucks have left for their last pull of the day, typically between 2:00 and 4:00 p.m., local small commercial haulers with tip-bed truck are allowed to use the tipping floor in the transfer station.

Public Opinion

There are no official gauges of public opinion regarding Huntsville's sanitation services. There are rarely complaints filed against the department, and these typically are related to a missed trash pick-up or a new citizen becoming acquainted with the schedule. There have actually been several "Letters to the Editor" written to the local paper praising the garbage collectors.

Comments from people who take their waste to the transfer station indicate that they are much happier with the transfer station than they were with the landfill because it is much cleaner. Citizens no longer encounter muddy areas at the landfill working face or encounter the odors associated with a MSW landfill, they simply place their waste in a roll-off box that abuts a concrete wall and pad.



The Huntsville Item

Thursday, December 24, 1998

LETTERS

Garbage collectors doing fine job

To the editor:

Huntsville has one city service that stands head and shoulders above any city I have lived in. We all can and should be proud of the city garbage collectors.

The gentlemen have an extremely difficult job and they do it to perfection, regardless of the weather. Neither you nor I could or would do the job half as well at twice the pay.

I do not know what their salary is, but it certainly is not enough for the work these men do. I believe a pay raise is in order and sincerely hope the community leaders agree and will act promptly.

BOB PRIEST
Huntsville

Hard Workers

To the editor:

I would like to hand out a "hearts" notice to the people in the City Sanitation Department that handle our garbage and trash!

These people do an excellent job every week. They are prompt on the proper days, they don't destroy the garbage cans, and they don't spill trash all over the street and leave it there. When it is raining, the cans are either re-covered or left upside down so they don't fill with rainwater.

All of their work is in either the summer heat of Huntsville or the bitter cold that has blown in from the North Pole, but they do good work anyway, and are friendly to the citizens to boot.

Hats off to the crew that handles East Lake Drive in Elkins Lake, and Happy New Year to these workers and their management!

TOM H. CHAMBERS
Huntsville

Costs

Huntsville has placed a high priority on managing and maintaining control of its solid waste collection and disposal system. They have been approached about privatizing their waste collection and disposal system. Every time the issue arises the city evaluates the costs involved with operating its own system. In the past they have found that privatization would cost about the same as the existing system. Since the city is interested in maintaining control over its solid waste services, they have always opted to retain control by operating their own solid waste services. The last such evaluation was in 1997.

The fiscal year 1998-1999 budget for total solid waste expenditures is shown in Table 13 and a breakdown of how the expenses are allocated is shown in Figure 8. Total Expenditures expected in FY 1998-99 is $3,279,628.

Table 13: Huntsville's Budgeted Breakdown of Total Solid Waste Expenditures for FY 1998-99

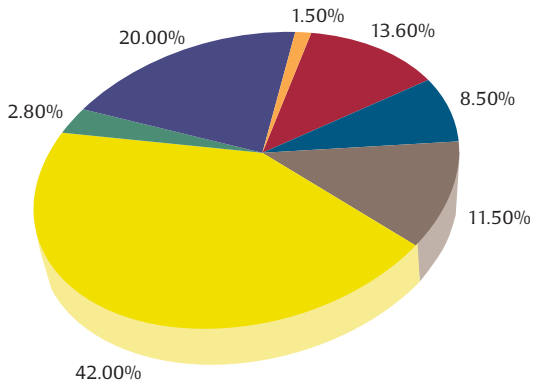
(Source: "City of Huntsville, TX, Fiscal Year 1998-1999, Annual Budget")

	Budgeted Amount
Salaries and Benefits	$ 1,023,446
Supplies	119,362
Maintenance of Buildings and Structures	38,000
Maintenance of Equipment	121,237
Services, Utilities	767,628
Insurance, Elections, Sundry	34,072
Capital Purchases/Projects	190,000
Administrative Costs	657,166
Debt Service	278,717
Miscellaneous	50,000
Total	**$ 3,279,628**

Figure 8: Huntsville's Projected Expenditures by Function for Fiscal Year 1998-1999.

(Source: "City of Huntsville, TX, Fiscal Year 1998-1999, Annual Budget")

	Percentage
Residential Collection	13.60
Debt	8.50
Commercial Collection	11.50
Solid Waste Disposal	42.00
Street Sweeping	2.80
Administrative	20.00
Reserve for Future Allocation	1.50



Capital

In 1993, Huntsville incurred a one-time $1.6 million dollar cost associated with closing the city's landfill and designing, constructing, registering, and equipping the transfer station. This amount was financed through a "Certificate of Obligation" which is a low interest loan to the city for a specific purpose.

The city's decision to close the landfill was based primarily on costs involved in keeping it open versus closing it. The city and TDCJ contracted with an engineering company to perform an evaluation of options available to the city. This study evaluated keeping the landfill open, closing the landfill and pursuing privatization, constructing and operating a transfer station, an incinerator, a material recovery facility, and a process that resulted in composting of the entire waste stream. Based on the analysis of costs involved in each option, a transfer station was constructed such that it could one day be transformed into a feed system for an incinerator or the option which allowed for composting the entire waste stream.

Currently, capital costs are incurred for specific equipment purposes, as discussed in later sections.

Equipment

Huntsville owns all of its garbage trucks, dumpsters, and transfer trucks. The city maintains all of the solid waste vehicles through its maintenance department. Therefore, no specific dollar values can be applied to repair of equipment. Maintenance of the rubber tire loader used at the transfer station requires that Huntsville spend approximately $8,000 per year to replace the tires.

City of Huntsville Transfer Station

Huntsville has utilized H-GAC's equipment procurement plans to obtain their residential garbage trucks. However, H-GAC's equipment procurement plan did not offer bid purchase on transfer trailers. After significant research on the subject, the city bid a new aluminum transfer trailer rather than steel because the aluminum trailer is comparable in cost, but can haul an additional four tons of waste per trip due to legal road weight limits. Trucks are purchased on a 5-year amortization schedule, funded by a Certificate of Obligation.

The transfer station is equipped with a bulldozer and a knuckle boom. These items were purchased in 1994 when the transfer station was being constructed and equipped. The bulldozer and the knuckle boom are maintained by the city's mechanics. The costs for maintenance associated with residential collection, commercial collection, and the transfer station are shown in Tables 14, 15, and 16.

Table 14: Huntsville's Budgeted Breakdown of Residential Collection Expenditures for FY 1998-99

(Source: "City of Huntsville, TX, Fiscal Year 1998-1999, Annual Budget")

	Budgeted Amount
Salaries and Benefits	$ 85,480
Supplies	22,400
Maintenance of Buildings and Structures	1,000
Maintenance of Equipment	23,520
Services, Utilities	7,335
Insurance, Elections, Sundry	7,598
Capital Purchases/Projects	0
Total	**$ 447,333**

Table 15: Huntsville's Budgeted Breakdown of Commercial Collection Expenditures for FY 1998-99

(Source: "City of Huntsville, TX, Fiscal Year 1998-1999, Annual Budget")

	Budgeted Amount
Salaries and Benefits	$ 248,473
Supplies	37,900
Maintenance of Buildings and Structures	0
Maintenance of Equipment	47,180
Services, Utilities	1,425
Insurance, Elections, Sundry	9,141
Capital Purchases/Projects	33,000
Total	**$ 377,119**

Table 16: Huntsville's Budgeted Breakdown of Solid Waste Transfer Station Expenditures for FY 1998-99

(Source: "City of Huntsville, TX, Fiscal Year 1998-1999, Annual Budget")

	Budgeted Amount
Salaries and Benefits	$ 330,594
Supplies	51,360
Maintenance of Buildings and Structures	37,000
Maintenance of Equipment	44,517
Services, Utilities	758,868
Insurance, Elections, Sundry	15,215
Capital Purchases/Projects	140,000
Total	**$ 1,377,554**

Labor

The city sanitation department employs both full and part-time employees. There are eight employees at the transfer station, thirteen residential collection employees, eight commercial collection employees including the one recycling center employee, one street-sweeper, and two managerial positions.

The labor cost associated with operating the recycling center is $32,000 per year. The waste diverted through recycling equates to approximately 1.5 transfer trailer loads per month, which offers about $8000 in savings per year. Essentially the recycling center is costing the city an additional $24,000 per year.

Labor costs incurred for maintenance of equipment, administration, and billing are covered in the 20% overhead fee that the sanitation department pays to the city general fund. The sanitation fund reimburses the general fund for cost incurred, administration, vehicle maintenance, labor, and billing as included in the calculation. Salary and benefits costs are shown above in Tables 13, 14, and 15.

Operations & Maintenance

There are no maintenance costs associated with maintaining the landfill because the city is exempt from groundwater monitoring. The site is leased to a person who grows hay on the old landfill acreage that is not being used for the transfer station diversion areas. Any maintenance costs that do occur (such as erosion repairs) will be paid for through the sanitation department operating budget.

Operation costs, excluding labor, associated with maintaining the transfer station are minimal because they are not charged for their water and sewer use. These are typically large expenses at a transfer station because the floor is cleaned with a pressure washer and the resulting leachate is disposed of through the sanitary sewer system. There is typically an industrial user fee associated with discharging leachate into the sanitary sewer system. Huntsville does pay for its electricity expenses, which is approximately $500 per month.

Disposal costs are paid on a per ton basis to the Brazos Valley Solid Waste Management Agency (BVSWMA). Huntsville weighs it's own vehicles and issues certified weight tickets. These are used to determine the volume disposed of at BVSWMA's landfill. The disposal rate paid by Huntsville is $20.50 per ton for solid waste and $13 per ton for grit. This amount is shown as services in Table 15.

The city pays $85 per 55 gallon drum of used oil filters, $85 per 55 gallon drum of antifreeze, and $0.05 per gallon of used oil diverted at the transfer station. Since this is a manned facility, there have been no problems with illegal dumping of used oil, used oil filters, or antifreeze. The transfer station only accepts these products in small quantities from citizens, not from businesses.

The city participates in the H-GAC tire disposal program in which they pay a specified amount per tire for disposal, or $75 per ton to have a trailer left at the facility and picked up when it is full. Generally a trailer is only used for "Trash Bash" days. Otherwise tires are stockpiled at the transfer station until enough have been accumulated to call the recycling company.

Administration

Cindy Blaylock serves as Huntsville's Sanitation Department Superintendent. A second administrator serves as the Sanitation Supervisor. All of the employees of the department report to an administrator as shown in Figure 9. The superintendent is responsible for all of the solid waste issues in the city including recycling, collection, disposal, the transfer station, the closed landfill, and the street sweeping. A great strength of Huntsville's solid waste program is the commitment of an entire department devoted to its success.

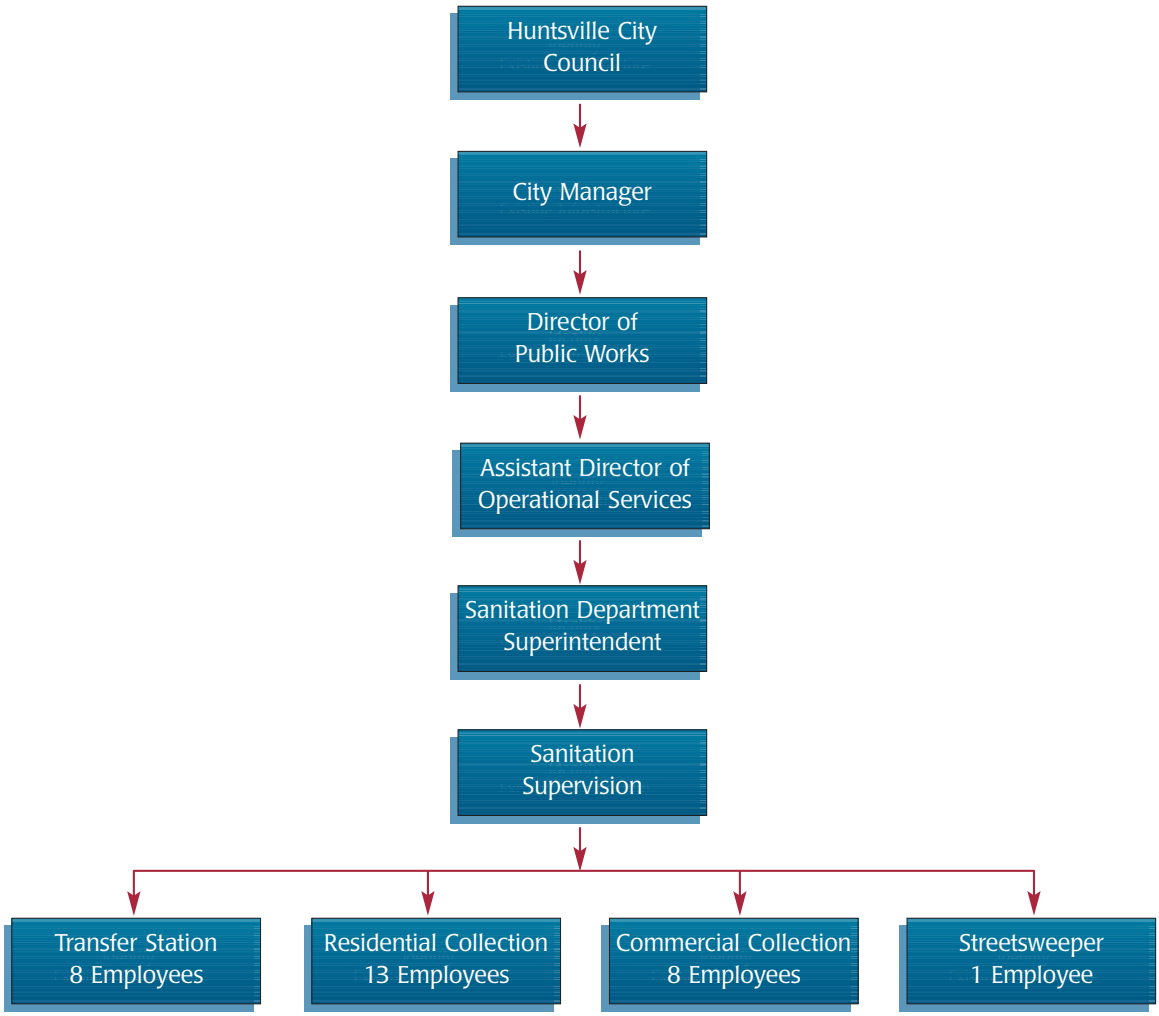


Figure 9: City of Huntsville Sanitation Department Organizational Chart

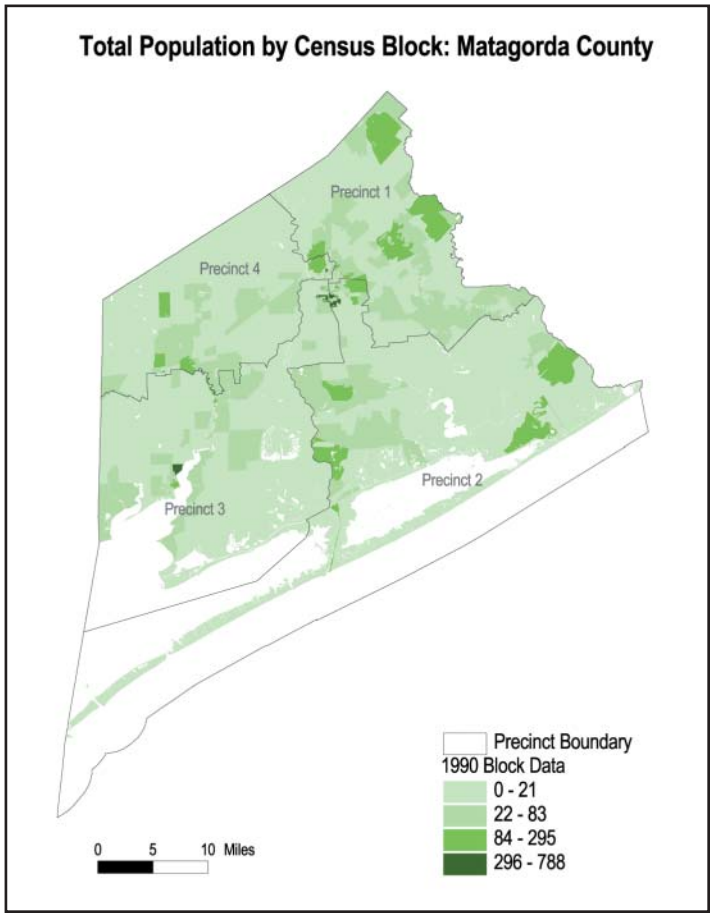
Huntsville's staff recommends that anyone interested in building a transfer station spend time speaking with operators of existing transfer stations. The design of the transfer station building dictates the type of loading equipment, transfer equipment, and the amount of solid waste tonnage that can be loaded for transferring each day. Talking with other operators about their transfer station operations, preventative maintenance, equipment, and building can reduce daily operation costs.

Matagorda County Case Study

Study Area Description

Matagorda County operated its own landfills until Subtitle D regulations became effective in 1994. In response to a need for a continued solid waste infrastructure, the county opened a CCS in 1992 and a transfer station in 1994. A second CCS is scheduled to open by the end of 1999. Residential collection services in unincorporated areas of the county are currently provided by commercial haulers. Large private haulers serve the two larger cities in the county, Bay City and Palacios, in both residential and commercial capacities.

The county is associated with a large consumer-recycling program in Bay City that serves most of the county. The CCS has a recycling collection area for those citizens who do not live close to a Bay City recycling drop-off. In addition to participating in household recycling collection, the county recycles items, such as tires, white goods, and metals. Matagorda County also organizes an annual household hazardous waste collection event.



The recycling facility is funded by WhaMCo (Wharton and Matagorda Counties) through Matagorda Services. The recycling program has been extremely successful. The center utilizes the mentally challenged people who work through Matagorda Services' many work programs. Bay City has been instrumental in establishing and supporting the recycling center, a work place recycling program, a school recycling program, and a composting program. Bay City also promotes recycling education through the use of a mascot, a brochure, and the formation of a solid waste commission.

Population

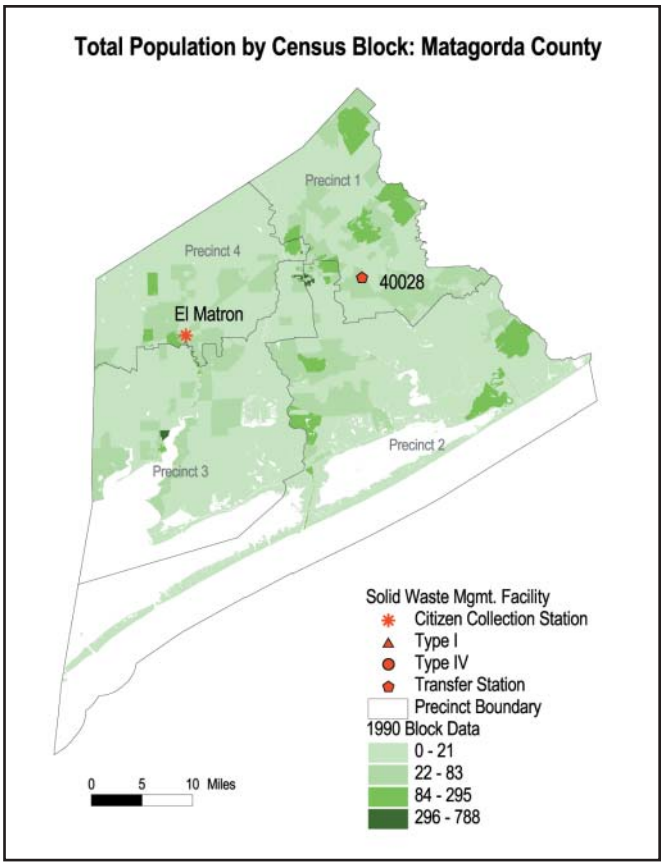
The population of Matagorda County is approximately 37,541. This figure includes the populations of the larger cities of Palacios and Bay City. The county is 59.5% urban and 40.5% rural. The average density is 33 people per square mile.

Palacios and Bay City contract their own solid waste collection systems and recycling programs. The waste collected from the people in these incorporated cities is not taken to a Matagorda County facility, so the populations of these cities will be removed from the total population number when determining cost per capita of the existing solid waste infrastructure.

Service Area

The transfer station and CCS serve the entire county population and a negligible amount of people from the City of El Campo. There is no data to verify this, but the county feels like they are serving more people now than when the landfills were operating because of the convenience of the new system. The landfill had illegal dumping problems at the gates, but the CCS and the transfer station have not experienced this problem.

This study will assume that the citizens of Palacios and Bay City will be utilizing the collection services offered to them through their municipalities. Although heavy trash services are offered through the private collection service, the study will assume that some heavy trash items will be taken to the Matagorda County CCS or transfer station. The general assumption that 1% of waste generated will be heavy trash will allow this study to include 0.5% of the Bay City and Palacios population in the cost per capita calculations.



Waste Generation

The waste collected at the El Maton CCS is hauled directly to a contracted Subtitle D landfill for disposal. Waste generation rates are shown in Table 17.

Table 17: Income at the El Maton CCS (1998)

(Source: Ed Schulze, Director of Matagorda County Environmental Health)

Source	Amount	Rate	Income
Measured Material	1541.40 cubic yards	$ 9.00 /cubic yard	$ 13,872
Weighed Material	127.00 tons	40.00 /ton	5,084
Fixed - Bags, Barrels, etc	-	-	7,076
Surcharge - tarp fees, etc.	-	-	5
Total			**$ 26,037**

Waste collected at the transfer station is also hauled directly to the contracted Subtitle D landfill. Waste generation rates at the transfer station are shown in Table 18.

Table 18: Income at Matagorda County Transfer Station (1998)

(Source: "Matagorda County Transfer Station Annual Report" by Matagorda County Environmental Health)

Source	Amount in tons	Rate	Income
Loose Tonnage	812	No-charge*	$ 0
Loose Tonnage	3,482	$40.00 /ton	139,263
Compacted Tonnage	58	No-charge*	0
Compacted Tonnage	1,725	$35.00 /ton	60,388
Fixed - Bags, Barrels, etc	-	-	5,300
Surcharge - tarp fees, etc.	-	-	455
Total			**$ 205,406**

** "No-charge" disposal originates from cleanup of illegal dumping, fairgrounds, beaches and county activities.*

Waste Stream

Matagorda County's waste stream is typical of that found in the H-GAC region. However, the recycling center in Bay City has been very successful in diverting recyclable materials from the county's waste stream. The majority of the waste collected at the CCS and the transfer station is Type I or Type IV waste.

Solid Waste Infrastructure

Illegal Dumping and Clean-Up Programs

Matagorda County experiences illegal dumping problems along its beaches, docks, and fishing areas, as well as in its rural communities. Illegal dumping is a problem in Matagorda County and it is treated as a serious offense. The county investigates sites that are found and prosecutes offenders to the maximum penalty allowed by the law. Finding the sites is a shared responsibility by many parties because neither the county nor the large cities have any mechanism in place to formally combat illegal dumping. The county cites and prosecutes illegal dumping offenders on a weekly basis. Fines are levied based upon state legal criteria. Illegal dumping sites usually consist of 2-3 bags of trash, a tire, and a piece of furniture. Occasionally tips are reported to the county regarding illegal burning of C&D materials by small commercial haulers or regarding illegal disposal sites. During the winter months, the Director of Health and Environment performs aerial reconnaissance for illegal disposal sites. Roadcrews continually watch for illegal dumping sites, and typically spend about one day per week cleaning up these sites.

Matagorda County does not require its small commercial haulers to register with the county at this time. They plan to implement this in the future as a means of monitoring collection and controlling illegal dumping.

Household Hazardous Waste Collection Day

Matagorda County Fairgrounds Saturday, September 28, 1996 9:00 a.m. - 3:00 p.m.

This Event Sponsored By:

County Of Matagorda **City Of Bay City** **Matagorda Services**

Lyondell Petrochemical **Hoechst Celanese**

For More Information Contact:

Robert Dean	**(409) 241-4168**	**Hoechst Celanese**
Hugh Vallely	**(409) 244-7141**	**Lyondell**
Rhonda Sanders	**(409) 245-7770**	**Matagorda Services**

"WHAT TO BRING CHECKLIST"

- _____ PAINTS
- _____ SOLVENTS
- _____ VARNISH
- _____ TIRES
- _____ PESTICIDES
- _____ HERBICIDES
- _____ DRAIN OPENER
- _____ OVEN CLEANER
- _____ STAIN REMOVERS
- _____ POLISH
- _____ HOBBY SUPPLIES
- _____ POOL CHEMICALS
- _____ TRANSMISSION / BRAKE FLUIDS
- _____ MOTOR OIL
- _____ ANTIFREEZE
- _____ ACIDS
- _____ BATTERIES
- _____ PHOTOGRAPHIC CHEMICALS
- _____ PRODUCTS LABELED: "**CAUTION**" "**WARNING**" OR "**POISON**"
- _____ CAR BATTERIES
- _____ USED OIL FILTERS
- _____ WHITE GOODS (REFRIGERATORS, AIR CONDITIONERS) - ALL FREON WILL BE CAPTURED.
- _____ LATEX PAINT
- _____ PLASTIC
- _____ GLASS
- _____ ALUMINUM
- _____ PAPER
- _____ COOKING OIL

Do Not Bring: Explosives, Radioactive materials, Dioxins, Waste generated by business or farms & Containers larger than 1 gallon (except for motor oil and paint).

Please transport all products in their original containers and do not mix them. Make sure the containers are properly sealed and will not leak. Put containers in the trunk or back of your vehicle, away from passengers.

Matagorda County holds one household hazardous waste collection day per year. Sponsors of the event are Matagorda County, Bay City, Matagorda Services, Celanese, and Equistar. Laidlaw Environmental, Waste Management, and Texas Brine also participate in the event. It is held at the county fairgrounds. The private companies fund the disposal costs of the collected materials through their existing hazardous waste disposal programs. Items accepted at this event are:

- Paints
- Solvents
- Varnish
- Pesticides
- Herbicides
- Drain Opener
- Oven Cleaner
- Stain Removers
- Polish
- Hobby Supplies
- Pool Chemicals
- Latex Paint
- Transmission and Brake Fluids
- Antifreeze
- Acids
- Batteries
- Photographic Chemicals
- Products labeled "Warning" or "Poison"

Items accepted at this event, that are disposed of through the existing Matagorda County and Bay City recycling programs are:

- Tires
- Motor Oil
- Car Batteries
- Used Oil Filters
- White Goods
- Plastic
- Glass
- Aluminum
- Paper
- Cooking Oil

Materials are only accepted from residents in containers smaller than 1 gallon (except for paints and motor oil). Volunteers from the community provide collection assistance at this annual event. In 1994, 100 volunteers collected 6,870 pounds of household hazardous waste (HHW); in 1995, 81 volunteers collected 13,251 pounds of HHW, including 262 car tires from 317 households; and in 1996, 141 volunteers collected 20,633 pounds of HHW, including 377 car tires from 480 households.

The City of Palacios currently holds one formal clean-up event each year as a city event. In the past, Matagorda County hosted formal "Clean-Up" days. Instead of hosting clean-up days, the county has found that it is much more effective to supply free boxes to a community once or twice during the year. The county will drop a couple of roll-off boxes at a location and leave them there for a few days so that the citizens can dispose of larger items at no cost. This has been very effective in cleaning up rural areas.

Bay City sponsors several clean-up activities. The annual "Texas Trash Off" is a litter control program in conjunction with Keep Texas Beautiful. An on-going clean-up event is the "Saturday Morning Clean Up Program." Every Saturday, brush, yard trimmings, furniture, appliances, and numerous household items are picked up and recycled, chipped for mulch, or disposed of properly. This program entails the cooperation of two governmental entities. The City of Bay City furnishes supervision for the workers and Matagorda County Adult Probation Program furnishes the labor. Approximately 2,080 cubic yards of residential waste is collected annually, or an average of 40 cubic yards per week.

Reduction, Reuse, and Recycling Programs

In 1990, a recycling program was initiated by the volunteer group, WhaMCO, to serve the two county region. The recycling drop-off center was placed in Bay City at a county precinct barn. The 4,000 square foot facility cost $75,000 to build. H-GAC Grant In 1991, the City of Bay City and Matagorda Services, Inc. assumed responsibility for the program. The center is currently sponsored by two governmental entities, three corporations, and one non-profit group.

Bay City Recycling Center

Recycling Bin at the El Maton CCS

Bay City subsidizes the recycling center with $33,000 annually and provides in-kind services. Matagorda County initially established drop-off recycling sites, containing segregated containers at the CCS and the transfer station. However, since the transfer station and the Bay City facility are close to each other, the transfer station no longer accepts recyclables. The second recycle collection box will be placed at the new CCS at the community of Matagorda. The county also provides in-kind services to the recycling center.

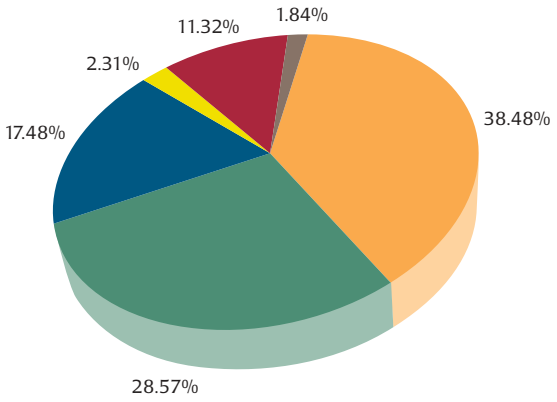
The types of waste being recycled at the center are used motor oil, used oil filters, plastics #1 and #2, cardboard, paper, newspaper, magazines, cooking oil, glass (three colors), steel cans, used batteries, and aluminum cans. The recycling center is available for citizens to drop off recyclable materials 24 hours a day, 7 days a week. During un-staffed hours there is a problem with people illegally dumping tires, trash, and other non-household recyclable materials at the center. The center is manned Monday, Tuesday, Thursday, Friday, and Saturday from 8:00 a.m. to 5:00 p.m.

The local hospital brings all of its shredded paper to the center and local bars repack all their empty bottles in cardboard boxes and bring them to the center for recycling. In 1995, a commercial cardboard route was started, utilizing the mentally challenged clients of Matagorda Services to collect cardboard and some paper from businesses inside the Bay City limits. This is a no-cost service to businesses, as it diverts two tons of cardboard from the landfill monthly.

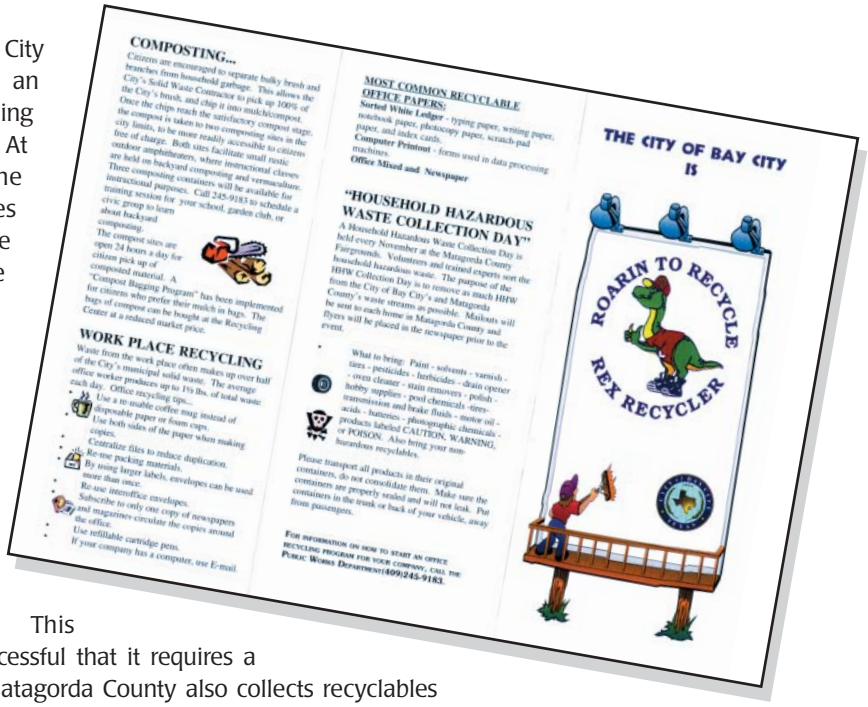
In 1998 a total of 782 tons of material were recycled at the Bay City recycling center. In addition, 7,350 gallons of used oil were recycled. The composition of the materials collected at the Bay City recycling facility are shown in Table 19.

Table 19: Bay City Recycling Center Collection Composition

(Source: Greg Crane, Director of WhaMCo Services)



Item	Tons	Percentage
Newspaper	301	38.48
Cardboard	224	28.57
Office Paper	137	17.48
Plastic	18	2.31
Glass	89	11.32
Steel	14	1.84
Total	**783**	**100.00**


COMPOSTING...

Citizens are encouraged to separate bulky brush and branches from household garbage. This allows the City's Solid Waste Contractor to pick up 100% of the City's brush, and chip it into mulch/compost. Once the chips reach the satisfactory compost stage, the compost is taken to two composting sites in the city limits, to be more readily accessible to citizens free of charge. Both sites facilitate small rustic outdoor amphitheaters, where instructional classes are held on backyard composting and vermiculture. Three composting containers will be available for instructional purposes. Call 245-9183 to schedule a training session for your school, garden club, or civic group to learn about backyard composting.

The compost sites are open 24 hours a day for citizen pick up of composted material. A "Compost Bagging Program" has been implemented for citizens who prefer their mulch in bags. The bags of compost can be bought at the Recycling Center at a reduced market price.

WORK PLACE RECYCLING

Waste from the work place often makes up over half of the City's municipal solid waste. The average office worker produces up to 1½ lbs. of total waste each day. Office recycling tips...

- Use a re-usable coffee mug instead of disposable paper or foam cups.
- Use both sides of the paper when making copies.
- Centralize files to reduce duplication.
- Re-use packing materials. By using larger labels, envelopes can be used more than once.
- Re-use interoffice envelopes.
- Subscribe to only one copy of newspapers and magazines-circulate the copies around the office.
- Use refillable cartridge pens.
- If your company has a computer, use E-mail.

MOST COMMON RECYCLABLE OFFICE PAPERS:

Sorted White Ledger - typing paper, writing paper, notebook paper, photocopy paper, scratch-pad paper, and index cards.

Computer Printout - forms used in data processing machines.

Office Mixed and Newspaper

"HOUSEHOLD HAZARDOUS WASTE COLLECTION DAY"

A Household Hazardous Waste Collection Day is held every November at the Matagorda County Fairgrounds. Volunteers and trained experts sort the household hazardous waste. The purpose of the HHW Collection Day is to remove as much HHW from the City of Bay City's and Matagorda County's waste streams as possible. Mailouts will be sent to each home in Matagorda County and flyers will be placed in the newspaper prior to the event.

What to bring: Paint - solvents - varnish - turps - pesticides - herbicides - drain opener - oven cleaner - stain removers - polish - hobby supplies - pool chemicals - tires - transmission and brake fluids - motor oil - acids - batteries - photographic chemicals - products labeled CAUTION, WARNING, or POISON. Also bring your non-hazardous recyclables.

Please transport all products in their original containers, do not consolidate them. Make sure the containers are properly sealed and will not leak. Put containers in the trunk or back of your vehicle, away from passengers.

FOR INFORMATION ON HOW TO START AN OFFICE RECYCLING PROGRAM FOR YOUR COMPANY, CALL THE PUBLIC WORKS DEPARTMENT(409)245-9183.

THE CITY OF BAY CITY IS

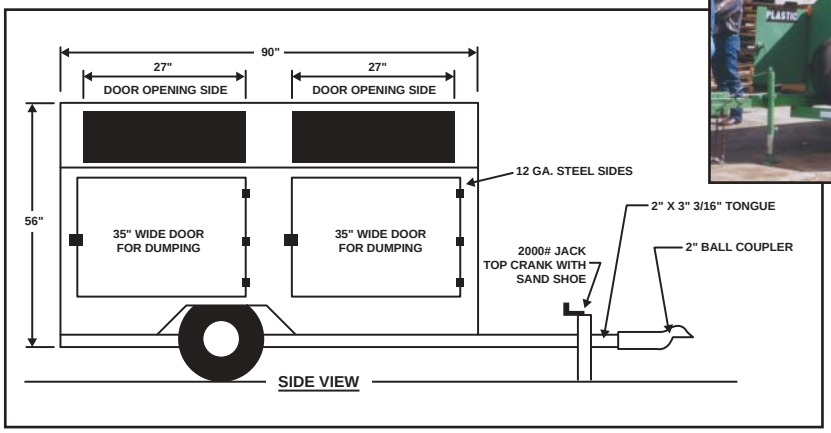
ROARIN TO RECYCLE REX RECYCLER

In September of 1996, the City of Bay City implemented an in-house work place recycling program for all city offices. At the beginning of the program, the city offices were only recycling white paper, however, the program quickly expanded to include aluminum cans, plastic soda bottles, and flattened cardboard boxes. The city averages 686 pounds (or 4.2 cubic yards of paper, 2 cubic yards of cans, and 1 cubic yard of plastic bottles) of recyclables per week. This program has been so successful that it requires a weekly collection route. Matagorda County also collects recyclables at its offices and sends them to the Bay City recycling center.

In November of 1996, four school districts began participating in the Countywide "School-Recycling Program" that operates in conjunction with the recycling facility. These schools combined payment is $5,410 per month for trash disposal. At the going landfill rate of $5.70 per cubic yard, this figures to roughly 11,389 cubic yards annually. This program accounted for 32 tons of the material recycled in 1998. The program involves Bay City, Matagorda Services, Inc., Matagorda County, and the independent school districts of Bay City, Matagorda, Palacios and Van Vleck. The purpose of the program is to remove as much white paper, computer paper, newspaper, cardboard, steel cans, aluminum cans, and other recyclables as possible from the waste stream of schools. An H-GAC grant H-GAC Grant allowed the program to purchase 16 segregated compartment recycling trailers that can be hauled by a half-ton pickup truck. A diagram of this trailer is shown as Figure 10. Each of the 16 campuses in Matagorda County has a trailer located on site. Each school district is responsible for maintaining and emptying of their containers. Those located within Bay City limits can call the Public Works Department for back-up pulls. Those within the county can call their county commissioner for back up. Each collection location has the option of opening the use of their container to the public. This allows remote areas of the county accessibility to recycling.

Rex the Recycler

Figure 10: Bay City Recycling Trailer Diagram



Trailer Diagram - Side View Only

The regional school recycling program is budgeted at $90,500. The largest cost is for the capital investment of the equipment. All other costs are in-kind labor and transportation costs that are shared by four school districts, four county commissioners, Bay City, and the recycling center. There are also educational program costs. Since there are approximately 7,795 students, implementation of the program cost per student is $11.92. The annual cost per student is $1.97. Since current landfill costs in the area are $5.70 per cubic yard, it is assumed that this program will have paid for itself within three years.

Bay City also has an in-house used oil recycling program. They collect approximately 300 gallons of used motor oil per month and one-half of a 55-gallon drum of crushed used oil filters.

In 1996, Bay City partnered with their solid waste contractor to compost brush and yard waste collected from residents, then make it available for city projects or for citizens use. The program collects 3,138 tons of brush annually. Once the brush and yard waste has been collected, it is chipped in a tub grinder supplied by the solid waste contractor. Bay City maintains the chipping site and is currently installing a water line H-GAC Grant to wet the chipped material as needed. A 2-1/2 cubic yard front-end loader was purchased for $85,000

H-GAC Grant to turn the chips for proper decomposting of the material into mulch. A trommel screen is leased two weeks, twice a year to allow the city to separate the fine compost product from the larger chips and sticks. Once the chips have reached the satisfactory compost stage, the compost is taken to a distribution site inside the city limits to be more readily accessible to citizens free of charge. Bay City distributes composted materials four or five Saturdays every six months. Because the program is so popular, they limit distribution to two cubic yards per car. Approximately 250 cars will come through the distribution center on a typical day. The distribution is advertised in the local newspaper.

Bay City Compost Learning Center

Bay City also constructed two compost learning centers with funds from H-GAC. H-GAC Grant Both sites have small rustic outdoor amphitheaters where instructional classes are held on composting and vermiculture. This service keeps residential costs on brush down and offers free compost and educational programs. The compost program diverts 39,000 cubic yards of material from landfills each year. At the current cost of $5.75 per cubic yard, this is saving Bay City residents $224,250 annually. Bay City recommends that any recycle facility be fenced because they have experienced several problems with theft and illegal dumping.

Matagorda County has evaluated adding a composting facility at the transfer station, but limited resources have not allowed it to happen at this time.


Bay City Compost Learning Center

Matagorda Services operates a pallet recycling facility in Bay City. Pallets are accepted, repaired, and then sold. Pallets that aren't repairable are chipped and sent to the composting facility. This program creates profits that are used to help fund the recycling center.

The City of Palacios is in the process of adding a wood chipping operation to their services. The service will be offered as part of an agreement with their solid waste contractor. Palacios does not currently have its own recycling program, but its citizens use the Matagorda County collection sites for recycling.

Bay City and Palacios have evaluated offering curbside recycling to residents, but have found the option to be much too expensive. The community base is too small for curbside recycling, but the CountyWide School Recycling Program allows one of the largest generators in the county, the schools, the opportunity to recycle. The previous problems of no local markets and long haul distances to Houston are solved because all entities are able to bring their recyclables to Bay City. The cost of recycling is distributed among many parties, keeping the cost manageable for all.

Bay City Compost Learning Center

Collection - Hauling, Transfer Stations, Citizens Collection Stations

Matagorda County has never seriously considered offering collection services to its residents. The needs of the community are served very well through the small commercial haulers. The county has considered promoting these small commercial haulers to increase the area serviced by them and to encourage the use of legal disposal methods. A service problem is that small commercial haulers in Matagorda County only offer collection of household municipal waste. The residents must dispose of heavy trash and brush on their own.

Matagorda Transfer Station

Since January of 1995, Matagorda County has operated a Type V transfer station equipped with an electronic scale, a knuckle boom, and two transfer trailers. The transfer station is designed and constructed to handle 100 tons per day. Matagorda County's transfer station and CCS are located on property adjacent to old landfills. The landfill adjacent to the transfer station is still considered to be active by TNRCC because several Type IV cells are still available for waste receipt. The landfill stopped accepting waste prior to the implementation of the Subtitle D regulations. Transfer station employees must also perform maintenance on the landfill.

Matagorda County operates one transfer station and one CCS. A second CCS is currently being installed to better serve the population. The CCS accepts household recyclables, but the transfer station does not because of its vicinity in relation to the Bay City recycling facility. County employees do not remove recyclable materials from the waste stream; they are only recycled if separated prior to disposal. The recycling center, the CCS, and the transfer station all accept scrap iron, tires, used oil, and used oil filters for recycling.

The transfer station does not maintain a separate CCS at its transfer station because it does not currently have any large trucks that dispose of waste at the transfer station that could possibly cause a safety hazard for local citizens. The knuckle boom crane used to compact the waste into the transfer truck is also used to unload materials for people (if an equipment operator is available).

Matagorda County is fairly happy with the design of their transfer station. It is large enough for 3 vehicles to unload at one time. The crane is located out of the way of disposal operations and people unload directly into the transfer trailer, rather then onto the tipping floor. A few suggestions were made by the operations staff to improve the design for operational needs.

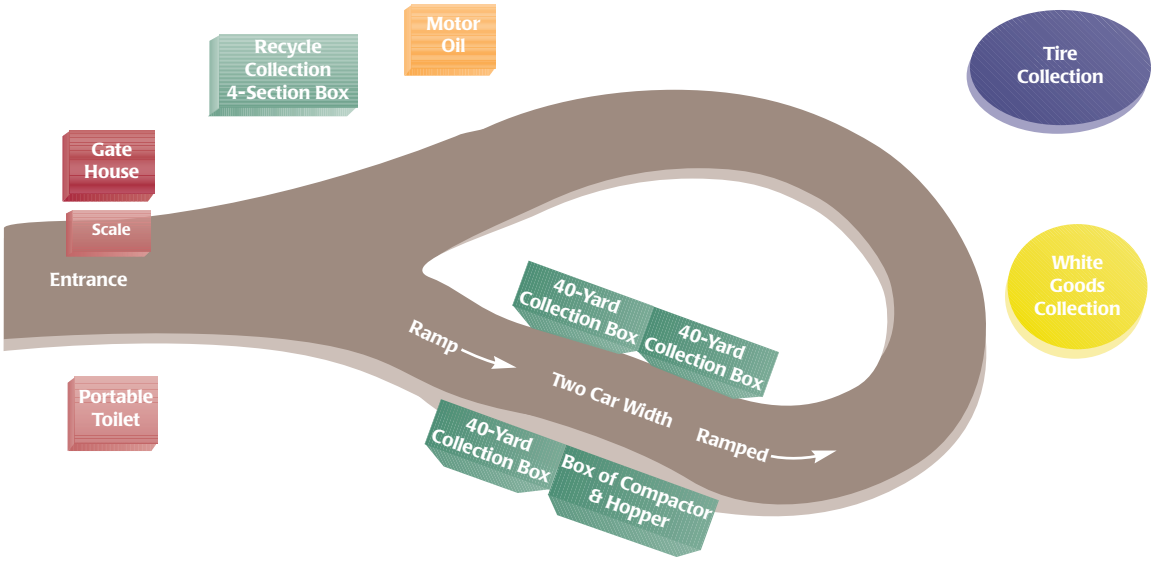
- For ventilation reasons the building opening should face North so that the summer winds cool and ventilate the building.
- The crane should be located a little closer to the opening so that the operator does not experience any blind spots while compacting or unloading waste.
- Drains should be strategically located and designed to avoid clogging.
- Ventilation fans should be placed close to ground level so that they can be used for dust control. Currently no dust control is available in the building.

Hours of operation for the transfer station are Monday through Friday, 8:00 a.m. to 5:00 p.m., and Saturday 8:00 a.m. to 4:00 p.m.

Matagorda County currently operates one CCS at El Maton and plans to open a second CCS in the community of Matagorda area by the end of 1999. A general layout of the El Maton CCS is shown as Figure 11. In siting the new CCS in Matagorda County, location, accessibility, and availability were the factors that most influenced site selection. None of the Matagorda County facilities are located near residential locations.

Hours of operation for the El Maton CCS are Monday, Tuesday, Thursday, Friday, and Saturday from 8:00 a.m. to 4:00 p.m. The new CCS will be near the beach and will be open three weekdays, Saturday, and Sunday due to the beach traffic.

Figure 11: El Maton Citizens Collection Station General Layout



Matagorda County spent approximately $854,175 to design and build its transfer station and CCS. This was completely funded through allocations from the county tax base and a grant from the H-GAC Grant for $40,000. Private companies have expressed interest in operating the transfer station, but the Commissioners Court wants to maintain control of the solid waste services. Initially, the facilities were operating on a cubic yardage basis, but have recently converted to scales. H-GAC Grant They have found that it has not significantly altered the income at the facilities, but the citizens view it as a much fairer and more equitable system. Rates for disposal at the El Maton CCS and the Matagorda County Transfer Station are shown in Table 20.

Table 20: Rates for Disposal at Matagorda County Transfer Station and El Maton CCS

(Source: Ed Schulze, Director of Matagorda County Environmental Health)

Waste Material**	Rate
Loose, Non Compacted Waste	$ 40.00 /ton
Loose, Non Compacted Waste (all classes)	9.00 /cubic yard ***
Asphalt Roofing Materials	16.00 /cubic yard ***
Compacted (Registered Commercial Collectors Only)	35.00 /ton
Barrels (contents only)*	3.00 each
Barrels (burn barrel contents)*	3.50 each
Barrels (burn barrel contents and barrel)*	5.00 each
Garbage bags (30 gal. Or less)	1.50 each
Garbage bags (30 gal. To 50 gal.)	2.50 each
Garbage bags (50 gal. Or larger)	5.00 each
Appliances (non-recyclable)	6.00 each
Refrigeration Units (non-compliant)	35.00
Tires (passenger car and light truck)	1.75 each
Tires (truck - 18″ to 24.5″ rim)	5.00 each
Tractor Tire (smaller than 16.9″ x 26″)	25.00 each
Tractor Tire (larger than 16.9″ x 26″)	50.00 each
Industrial - Commercial Tire	150.00 each

* *Barrels that have been burned within the previous seventy-two (72) hours will not be allowed to be unloaded or deposited at any Matagorda County waste facility in order to prevent fire hazards.*

** *No commercial collectors are allowed to unload at the CCS.*

*** *Cubic yard rates have been discontinued as of 1998.*

Pursuant to Section 325.140 of the Texas Municipal Solid Waste Management Regulations, the facilities charge a fee of $5 for any load, which is not adequately enclosed. Inadequate enclosure is defined as any waste not covered with a tarpaulin, net, or other means to properly secure the load and prevent the escape of any part of the load by blowing or spilling.

El Maton CCS

Matagorda County does not currently participate in the H-GAC tire collection program. They have continued to utilize the service offered by Safe Tire (from San Antonio). This is the same service they used prior to the changes in the tire program. They realize that it costs a little more than the H-GAC program, but the consistency of the service from Safe Tire and the prior relationship has retained their business. The county stockpiles the tires on the ground, then uses prisoners from the county jail to load the tires into the transfer trailer. The local tire dealers utilize alternate means of disposal of their used tires.

El Maton CCS Gatehouse

Disposal - Landfilling, Incineration

Prior to Subtitle D implementation, Matagorda County operated two landfills, an 80-acre site and a 5-acre site. Landfill space was running out just as the Subtitle D regulations were being implemented, so the county decided to close its landfills and open a transfer station. No formal study occurred to evaluate options for the county. The County Commissioners Court simply elected to close the landfills and open one transfer station and one CCS. The 80-acre landfill still has a few cells available for C&D waste disposal, but the county has not elected to fill these cells thus far.

There have been alternate waste management options proposed by private entities since the closing of the landfills, but none have come to fruition. An incinerator was proposed and an agreement was formed with the county to lease property, however, public opposition caused the project to stop and the county to dissolve its relationship with the private company.

Current disposal activities utilize trucks owned by the county to transport the waste from the CCS to the transfer station. The waste from the transfer station is trucked to Brazoria County landfill, which is owned and operated by Republic Waste Industries. The county owns its own 45-foot, 105-cubic yard transfer trucks that take the waste from the transfer station to the landfill. The Brazoria County landfill is 37 miles each way from the transfer station. The other disposal options are 65 miles each way to Waste Management's Coastal Plains landfill or 70 miles each way to Laidlaw's TriCell landfill (which is closing in 1999). Texas Disposal Systems' Austin landfill is 160 miles each way. Waste Management operates a transfer station for the City of Wharton, which is closer to the county's transfer station than all the landfills except the Republic facility. Matagorda County pays $5.25 per cubic yard for disposal at the Brazoria County landfill.

The transfer trucks make approximately eight trips per week to the landfill (or 800 cubic yards per week). The CCS makes three to four trips per week into the transfer station. Matagorda County currently pays a gate rate of $5.25 per cubic yard at the Brazoria County landfill. Republic Industries estimates that this equates to approximately $26.00 per ton.

Waste Management transports the waste it collects from Bay City and Palacios to Coastal Plains landfill in Alvin. Matagorda County has the ability to receive this waste, and did so when BFI held the local collection and disposal contracts. However, Waste Management has opted to dispose of the waste at its own facility. The travel distance from Bay City to the Coastal Plains landfill is 65 miles each way. Waste Management also handles the majority of commercial collections in the county.

Regulatory Requirements

Matagorda County officially closed its landfill with TNRCC permit number 1093 in 1996. The CCS is registered with the TNRCC. The tire collection and used oil collection are also registered activities with the TNRCC. Bay City's recycling facility is not a regulated facility, and does not hold any permits or registrations with environmental agencies.

System Effectiveness

The Matagorda County system is very effective in serving the needs of its citizens through intergovernmental cooperation. Their utilization of the mentally challenged work services is an innovative means of making recycling more affordable.

The county realizes it needs to add more permanent CCSs, but it has made a good start with the drop box program currently in existence for rural areas.

Public Opinion

Citizens satisfaction with the waste disposal system offered by Matagorda County is high. The citizens like the transfer station and the CCSs much more than they did the old landfills because they are cleaner and easier to use. However, people do complain about the fees. One of the old landfills was free to residents, and now they must pay to use the facilities.

Costs

All expenditures are currently funded through the county tax base. A budget is allocated for operation of the transfer station and CCSs each year as shown in Table 21. Additional capital expenditures can be requested for special projects through a formal proposal system, such as occurred for the addition of the second CCS. The operations at the transfer station and the CCS typically break even. The disposal fees are re-evaluated annually and altered to reflect increases in expenses at the facilities.

Table 21: Matagorda County Actual 1997 and Budgeted 1999 Solid Waste Expenditures

(Source: Matagorda County Courthouse Records)

Item	1997 Actual	1999 Budget
Salary - Assistants	$ 77,365	$ 83,701
Overtime	9,951	10,000
Medicare	1,243	1,359
Group Health Insurance	13,295	14,580
Retirement	6,641	6,934
Workers Compensation Insurance	4,050	0*
Unemployment	429	450
Alternate Retirement	5,957	6,419
Total Personnel Costs	**118,751**	**123,443**
Travel and Trip Costs	1,556	1,500
Supplies	2,298	2,500
Fuel	11,124	7,000
Professional Services	159	8,000
Telephone	585	900
Utilities	6,897	7,000
Repair & Maintenance - Equipment	28,723	11,000
Road Materials	0	0
Rentals	665	2,500
Rentals - El Maton	0	0
Spraying	0	3,000
Disposal Costs	226,259	236,000
H-GAC Household Hazardous Waste	12,934	19,700
Seminars & Association Dues	93	1,000
Total Operating Costs	**$ 291,293**	**$ 300,100**
Machinery & Equipment	$ 0	$ 1,000
Building	0	0
Total Capital Outlays	**$ 0**	**$ 1,000**
Total Solid Waste Costs	**$ 410,044**	**$ 424,543**

** Worker's Compensation Insurance is $0 because the county is self-insured.*

Capital

Matagorda County has used H-GAC grant funding and allocated tax money to fund their capital projects. They have a very effective informal partnership with the City of Bay City and the City of Palacios for funding projects. Matagorda County spent $854,775 to design and build its transfer station and CCS, as shown in Table 22. This was completely funded through allocations from the county tax base and a grant from H-GAC for $40,000.

Table 22: Total Cost of Initializing Matagorda County Transfer Station

(Detailed information can be found in Appendix 2)

Land - Located at Old County Landfill	$	0
Engineering and Design		48,000
Construction		724,225
Transfer Trailers		69,050
Heavy Truck		47,240
Recycling Container Boxes		13,500
Total	**$**	**902,015**

In 1993, Matagorda County began design and construction of a Type V Solid Waste Transfer Station. The Commissioners' Court subsequently approved requests for funding to contract with an engineering firm and a construction company. The contract agreement with the engineering firm was in the amount of $48,000. A copy of the agreement between Matagorda County and the engineering consulting firm is in Appendix 3. The contract agreement between the construction firm and Matagorda County for the construction of a solid waste transfer station was in the amount of $724,225. A copy of the agreement between the construction company and Matagorda County, a schedule of values, and a project timeline are in Appendix 3.

In 1994, two transfer trailers were purchased at a cost of $34,525 each. This price includes the freight to Bay City, where the trailers are stationed. In June 1994, a heavy truck was also purchased for the Matagorda County Solid Waste Transfer Station. This vehicle cost $47,240. The specifications used to bid the purchase of these vehicles can be found in Appendix 3. Three 20-yard roll-off recycling container boxes were also purchased at a cost of $4,500 each, yielding a total cost of $13,500.

Equipment

Matagorda Transfer Station

In 1997 Matagorda County secured additional items for the CCS through H-GAC grants. H-GAC Grant A scale was installed at a cost of $33,000. A copy of the grant application is included in Appendix 3. The grant application gives detailed information about costs involved with this addition and the specifications used to select the scale.

Equipment expenses were paid for either through a special capital request or through the annual operating budget. Matagorda County also provided matching funds for grants received from H-GAC for recycling equipment. In 1993, the Commissioners Court approved expenditures of $17,500 for the Bi-County Recycling Program to purchase drop-off trailers.

Labor

As is shown below in the Administration section, the Solid Waste Division employs six people at the transfer station and CCS, as well as one director. Their salaries are paid for out of the operating budget of the division. There is no county engineer to provide support to the waste service staff. All work is handled by outside consulting firms. Labor costs are shown in Table 20.

Operations & Maintenance

In 1996, Matagorda County received a waste oil grant from TNRCC to collect and recycle waste oil at its transfer station, CCS, and the bi-county recycling facility located in Bay City. The grant application is provided in Appendix 3 to demonstrate the detailed breakdown of costs involved in starting such a collection program. The grant total was in the amount of $17,768.

In 1994, Matagorda County applied for and received a grant from H-GAC to conduct a countywide household hazardous waste collection day. The amount of the grant was $20,000.

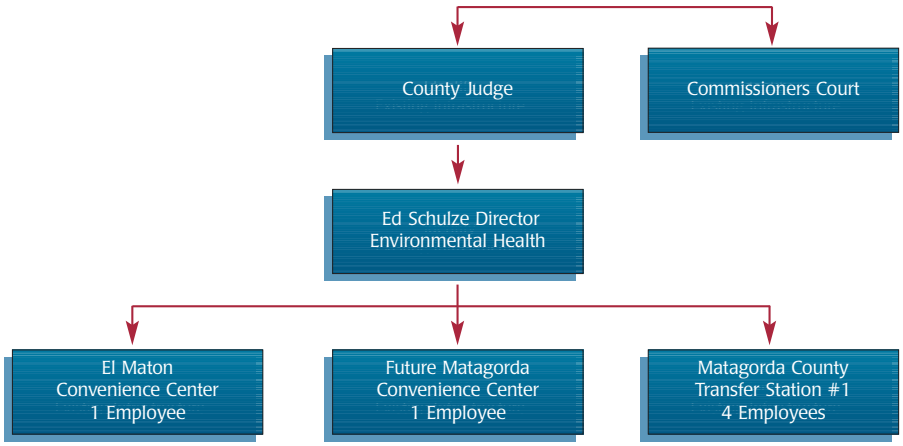
In 1997, Matagorda County contracted with Laidlaw to dispose of items collected at their household hazardous waste collection day. A copy of the contract between Matagorda County and Laidlaw is in Appendix 3 to demonstrate the contents of such an agreement. Also included in the agreement is a price schedule showing the costs involved with disposing of hazardous waste materials.

Operations and maintenance costs are paid for from the operating budget of the Solid Waste Division or through grants for specific purposes. Maintenance of the vehicles is performed by local repair shops on an as-needed basis.

Administration

Administration costs are paid for from the general operating budget of the Solid Waste division. Administrative costs include supplies, administrative salaries, etc. The solid waste services in Matagorda County are administered by the Director of Environmental Health. This person is responsible for a wide variety of environmental issues, and therefore isn't specifically focussed on solid waste. The structure of the solid waste operations staff is shown in the organization chart presented as Figure 12.

Figure 12: Matagorda County Solid Waste Organization Chart

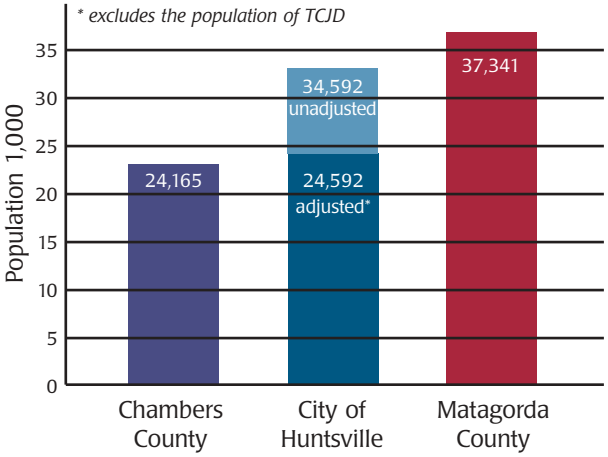


Case Study Comparisons

Demographics

The populations found in the case study areas are very similar to each other. The counties have a much smaller density rate (people per square mile) than the City of Huntsville. Chambers and Matagorda counties must service rural communities, while Huntsville services a more urban area. The populations of each case study are shown in Figure 13.

Figure 13: Case Study Population Comparison



Solid Waste Infrastructure

The solid waste infrastructures in the case study examples are unique to their community. Chambers County offers the most comprehensive overall system to its residents. Huntsville provides the most services to its residents and maintains control of the system. Matagorda County provides its residents with a means of legal disposal that is fairly convenient. They are continually improving their ability to meet the rural community needs by providing mobile collection services. The services provided by each case study are shown in Table 23.

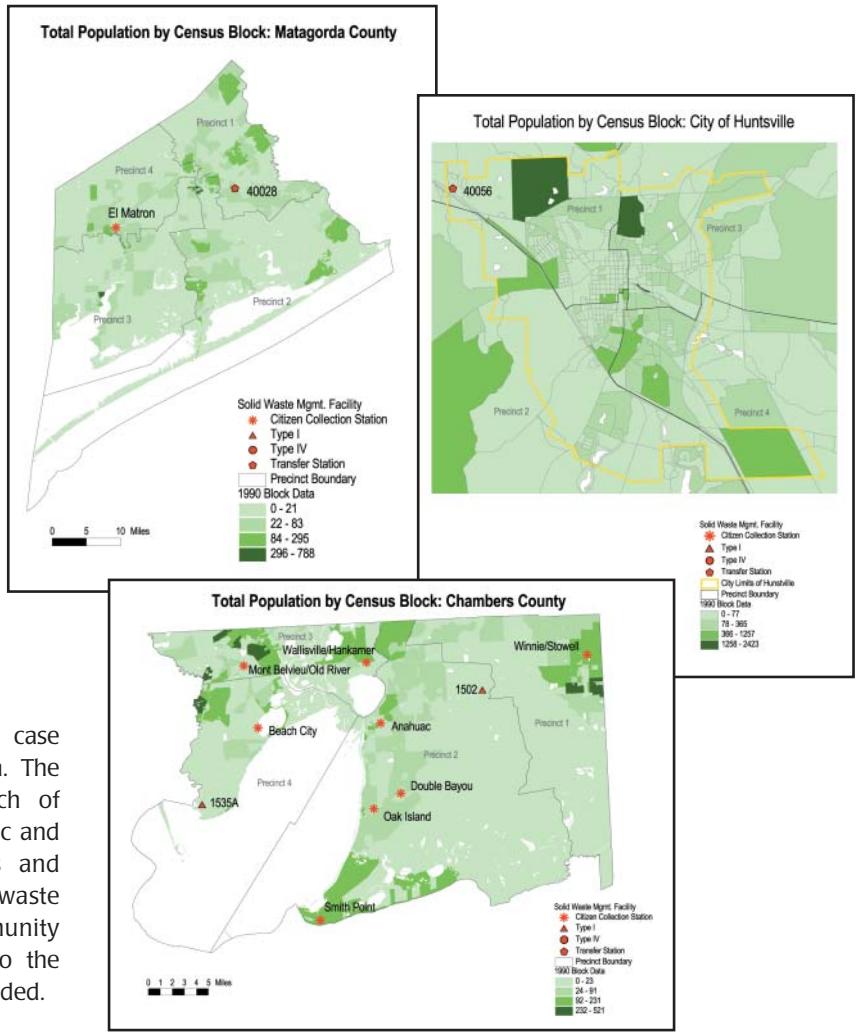
Table 23: Case Study Solid Waste Infrastructure Comparison

Area	Residential Collection	Commercial Collection	CCS	Transfer Station	Landfill	Incinerator	Recycling
Chambers County			8		Active	X	
City of Huntsville	X	X		1	Closed		X
Matagorda County			1	1	Inactive		X

Effectiveness

Each case study is effective in reaching the larger populations in their community, as shown in Figure 14. They have all been innovative in creating means of funding system expansions and enhancing their systems.

Figure 14: Case Study Effectiveness in Targeting Largely Populated Regions



Chambers County is very progressive in their pursuit of an incinerator. Huntsville's partnership with TDCJ has allowed them to operate their transfer station without placing the full expense solely on the citizens. Matagorda County's partnership with Bay City, Palacios, and Matagorda Services to continually enhance the recycling programs provides an excellent example of utilizing community resources and the benefits of partnering with others.

Public Opinion

Public opinion of all three case study systems is very high. The outstanding factor in each of these is educating the public and communicating the goals and actions of the solid waste departments. Each community has responded positively to the programs and services provided.

Of course individual cost to the citizens is always an issue. Chambers County does not charge for disposal so this is not an issue for them. Huntsville and Matagorda County citizens have accepted rate increases because they don't occur very often and they see the progress made by the departments in cleaner facilities, recycling, composting, etc.

The recycling programs are well received in all areas. Chambers County has been able to operate without providing recycling thus far because private companies offer the services.

Costs

The costs incurred by each of the case study groups can not be generally compared on an expense or income basis. To equate the costs and create a reference, they will be compared on a cost-per-capita basis. There are many factors that will alter solid waste expenditures per capita, such as when cities within a county utilize private services. These will be ignored. Several reasons allow for this: 1) information regarding costs involved with private services is not readily available; 2) costs incurred by the county are generally assumed to cover all residents of unincorporated areas of the region; and 3) additional services provided to urban residents are paid for through the municipal taxes.

Chambers County calculations are straightforward because there is very little income generated (they do accept a very small amount of waste from outside the county for a fee). The income is so small that it will be assumed to be 0.

Chambers County's population is 25,000. The amount spent on solid waste services in 1998 was $1,579,401. The cost per capita is therefore, $63.18 per year. Chambers County bears the full expense of this through its tax base.

The City of Huntsville calculation is fairly complicated due to the many factors involved. The population of Huntsville is 34,592. Since the collection routes service an additional two miles into the ETJ for the businesses only, this will be ignored because the additional population is a minute additional percentage. However, the number of people included in this number but serviced by TDCJ is approximately 10,000. Therefore, Huntsville's population serviced by residential collection routes is 24,592. The cost for fiscal year 1998-1999 for residential collection was $447,333. Therefore, the annual cost-per-capita of residential collection is $18.19. The commercial collection routes service the same population of 24,592 plus an additional 2,900 in the ETJ for a total of 27,492. The fiscal year 1998-1999 commercial collection costs were $377,119. Therefore the annual cost-per-capita of commercial collection is $13.72.

Huntsville's transfer station services all of Walker County, but is owned and operated by Huntsville. Since Huntsville bears the full responsibility for managing the station, the population of Huntsville will be used in determining the cost-per-capita figure. In this calculation the population will include the population of the TDCJ because their waste comes to the transfer station. Therefore, 34,592 will be used as the population for this calculation. The fiscal year 1998-1999 transfer station and disposal expenditures were $1,377,554, or $39.82 per capita. Huntsville recovers the majority of this expense through fees. Fees are adjusted as needed to cover rising costs.

Table 24 tabulates the total cost-per-capita for the City of Huntsville. The total cost-per-capita is $71.73.

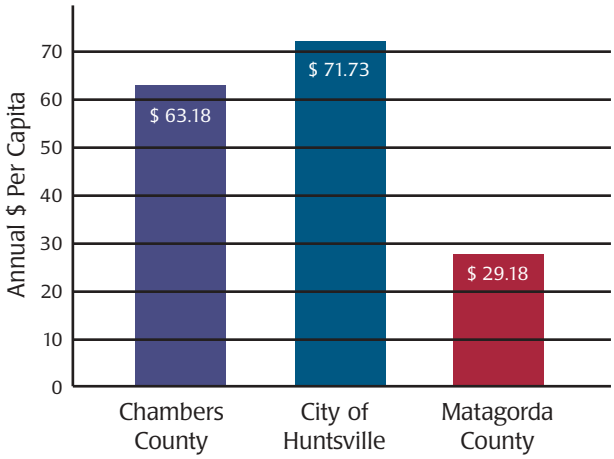
Table 24: City of Huntsville Cost-Per-Capita Summary

Service	Individual Cost-Per-Capita
Residential Collection	$ 18.19
Commercial Collection	13.72
Disposal at Transfer Station	39.82
Total	**$ 71.73**

Matagorda County's cost-per-capita calculation is also complicated. Matagorda County includes two major cities, Bay City and Palacios, who both take their waste out of the county for disposal. Although these people are serviced with regular and heavy trash collection, it is safe to assume that 0.5% of the waste generated by the population of these cities will be taken to the Matagorda County facilities. The population of Matagorda County is 37,541. The posted populations of Bay City and Palacios are 18,400 and 4,710, respectively. Therefore, the total population of both Bay City and Palacios is 23,110. One half of a percent of this is 115 people. So, the population serviced by the Matagorda County solid waste services is assumed to be 37,541 minus 23,110 plus 115, or 14,546. The 1999 budgeted solid waste expenditures were $424,543, or $29.18 per capita. Matagorda County charges users with a pay as you go system that allows it to break even. Rates are adjusted as needed to cover any rising costs.

Figure 15 provides a comparison of the case studies on a cost-per-capita basis. Huntsville has the highest cost-per-capita because of the door-to-door collection services. Chambers County's cost-per-capita represents their operation of their landfill and capital expenses toward the design of their future incinerators. Both Huntsville and Chambers County include depreciation of past capital expenditures related to implementation of their facilities. Comparatively, Matagorda County has a very low annual cost-per-capita. The capital outlay for their facilities was paid at the time of their implementation and is not shown as a depreciation expense in current annual expenses. They are also very resourceful in their use of grant funding and partnerships with other governments, local industry, and volunteer groups.

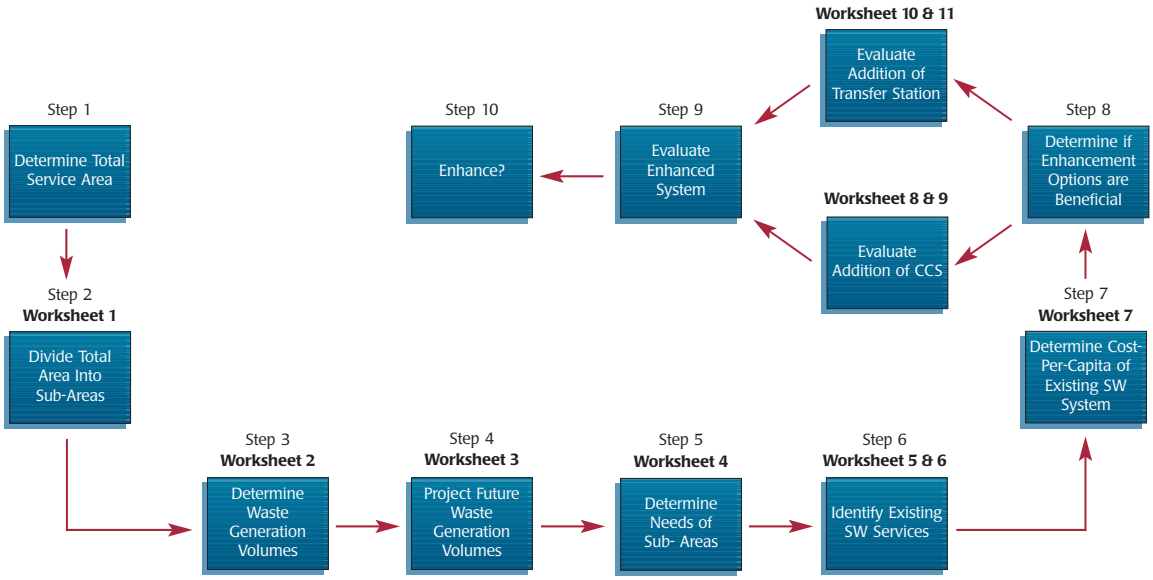
Figure 15: Case Study Comparison of Cost-Per-Capita of Existing Solid Waste System



IV. SOLID WASTE INFRASTRUCTURE EVALUATION

A flow chart of the evaluation process is shown as Figure 16. The process includes working through several worksheets and creating several area maps. The user should expect to spend three to twelve months to complete a thorough evaluation.

Figure 16: Flow Chart of the Solid Waste Infrastructure Evaluation Process



Demographics

Service Area

The first step in evaluating a solid waste system is to determine the service area. In a rural setting there may be several highly populated areas separated by vast amounts of very low-density land. Begin this exercise by determining the boundaries of your total service area. This is typically county lines or ETJ's of cities. Next, the total service area will be divided into sub-areas, which will be used to determine locations of proposed solid waste infrastructure improvements. These sub-areas are more densely populated areas, separated by lower density areas. Make sure all areas of the total service area are included in one and only one sub-area. Use Worksheet 1, "Total Solid Waste System Demographics", found in Section V to determine your sub-areas.

Worksheet 1

Population data can be obtained from H-GAC, electricity hookup and disconnect service records, county tax records, aerial photographs, or the website http://venus.census.gov. Also, the general knowledge of local officials can serve as a valuable resource to gauge the accuracy of the population assessment.

Waste Generation and Waste Stream

The next step in evaluating a solid waste system is to determine the volume of waste the system needs to handle. The data needed to determine volume includes estimated population of the sub-areas and monthly generation of waste per person. The population of each sub-area was determined in the prior step using Worksheet 1. Transfer the sub-area populations to Worksheet 2, "Waste Stream of Sub-Areas", found in Section V. Continue working through Worksheet 2 as you read this section.

Worksheet 2

Evaluate each sub-area to determine other users who may benefit from the addition of a solid waste facility. This generally applies only to sub-areas which lie on the outer perimeter of the total service area. For example, Huntsville's transfer station was constructed by the city, but serves almost all of Walker County. Estimate the additional population that would potentially use the new solid waste facility. Place this additional expected population in column B of Worksheet 2. Add columns A & B to determine the total serviced population.

Sub-Area Population + Other Population = Total Serviced Population

Place the total serviced population in column C of Worksheet 2.

The average disposal rate per person in the H-GAC region is 6.15 pounds per person per day. If waste generation data is available for the specific area, it should be used. Proposed facilities for a sub-area must be able to accept the volume found by multiplying the total serviced population of the sub-area by the average disposal rate per person.

EXAMPLE: Volume = 6.15 pounds per day * Population

This number is converted to tons by dividing by 2000 (2000 pounds per ton).

EXAMPLE: Volume (tons) = Volume (pounds) / 2000 pounds per ton

Since this disposal rate was determined using a waste generation study, it needs to be discounted for waste stream diversions to determine an accurate solid waste collection rate.

The waste stream makeup will have an impact on the quantity of the waste generation that will be calculated. If 50% of the waste stream is yard waste and is already being diverted to a local composting facility, this should be considered in the calculations. Municipal waste characterization in the H-GAC region has the makeup shown in Table 25.

Table 25: Projected Municipal Solid Waste Characterization of the H-GAC Region

(Source: "Solid Waste Management Plan for the H-GAC Region, February 1994")

Materials	Tons Generated in Year 1997	Percentage of Total Waste Stream
Paper and Paper Board	2,071,051	41.07
Corrugated	668,550	13.26
Newsprint	363,342	7.20
Books and Magazines	164,715	3.27
Office Paper	237,384	4.71
Commercial Printing	138,070	2.74
Other Paper	498,990	9.89
Glass	268,872	5.33
Metals	392,410	7.78
Ferrous	283,407	5.62
Aluminum	75,091	1.49
Other Non-Ferrous	33,912	0.67
Plastics	450,545	8.93
Rubber and Leather	118,692	2.35
Tires	48,446	0.96
Others	70,246	1.39
Textiles	99,314	1.97
Wood	179,249	3.55
Food Waste	319,741	6.34
Yard Waste	799,353	15.85
Sludge	205,894	4.08
Other Inorganic	65,402	1.30
Other Organic	72,668	1.44
Total MSW Generated	**5,043,191**	**100**

The difference between the amount of residential waste generated and the amount collected will typically vary between 8 and 15 percent. Most waste stream diversion can be accounted for by the amount of material: (1) composted; (2) burned in fire places or outdoors; (3) discharged to sewers; (4) given to charitable agencies; (5) sold at garage sales; (6) delivered to drop-off and recycle centers; and (7) recycled/reused directly. Reduce the total volume expected for disposal by the amount of the waste stream that can be easily recycled through an existing program. This will be accomplished by placing the recycling reduction rate in column G of Worksheet 2.

Non-participation rates should also be considered. The typical non-participation rate includes customers that: (1) are willing to make the drive to a MSW landfill themselves; (2) prefer to legally burn, dispose, or compost their waste; (3) are currently serviced by a suitable disposal service; or (4) are going to continue to illegally dispose of the waste. A good way to obtain an area specific non-participation rate is to survey the population. Ask if they will use the proposed solid waste infrastructure and how much they are willing to pay for it. An alternate method of determining the non-participation rate is to ask private or public solid waste providers in the area what their non-participation rate is. Place the non-participation rate for each sub-area in Worksheet 2, column H.

The estimated disposal volume can now be calculated. Multiply the estimated volume in tons by one minus the sum of the recycling reduction rate and the non-participation rate:

$$\text{Estimated Volume} \times \left(1 - \frac{\text{Recycling Reduction Rate}}{100} - \frac{\text{Non-Participation Rate}}{100}\right) = \text{Estimated Disposal Volume}$$

Now that an expected volume of waste has been determined, the peak demand must be calculated. Solid waste generation varies daily, weekly, and monthly (or seasonally), so it is important to determine needs based on these peak generation times. Residential waste generation usually peaks during the winter holidays and spring yard and housecleaning. Although needs should be based on peak rates, revenue estimates should not. Therefore, Worksheet 2 assists in determining both the peak volumes and the average volumes. The weekly peaking factor can be determined using regional or local data or it can be taken from Table 26. To determine the estimated peak daily disposal demand, multiply the daily disposal volume by the daily peaking factor. Column K should display the peak daily volume in tons.

Peak Volume = Disposal Volume x Peak Factor

Use Worksheet 2 to factor this into the total capacity needed for the facility.

Table 26: Peak Waste Generation Factors for Solid Waste for Small Communities Based on National Data (The values are exclusive of extreme waste generation events that are greater then the 99-percentile or less than the 1-percentile value.) (Source: **Integrated Solid Waste Management**, by Tchobanoglous, George, Hilary Theisen, and Samual Vigil, 1993.)

Worksheet 2

Table 26: Peak Waste Generation Factors for Solid Waste for Small Communities

Based on National data (The values are exclusive of extreme waste generation events that are greater than the 99 – or less than the 1 – percentile value)

Time Period	Range	Typical
Peak day	1.5 - 2.5	2.00
Peak Week	1.25 - 2.0	1.75
Peak Month	1.25 - 1.75	1.50

To determine the size and number of containers required to hold the tonnage of waste expected, total cubic yards must be calculated. If compaction systems are used at the solid waste facility, divide the tonnage total by 0.333 to determine cubic yards per day. If non-compacted collection will occur, divide the tonnage total by 0.2 to determine total cubic yards per day.

Worksheet 3

Finally, waste generation needs to be projected for up to 15 years. Generally solid waste planning projections for infrastructure needs should be on a 10-15 year basis. Worksheet 3, "Waste Stream Projections," within Section V will assist in these projections. Using the regional population growth rate, project volumes, continuing to make the assumption that people generate 6.15 pounds of waste per day unless area specific data is available. Perform these calculations in tons. If population growth data is not available for your specific area, use the H-GAC regional rate of 1.99% per year. This growth rate is a compounded figure so each calculation should be performed in order from year 0 to year 15. Each new calculation should use the prior year's solid waste volume. Before projecting annual volumes, the daily average and peak volumes must be converted to annual amounts. Worksheet 3 begins with these conversions.

Solid Waste Infrastructure

Next, determine the needs of each sub-area. Use Worksheet 4, "System Evaluation - Infrastructure Needs," found in Section V to evaluate what is needed in each sub-area. The existing solid waste infrastructure must be evaluated so that needs can be accurately determined. This exercise requires the use of area maps, which can be obtained from H-GAC.

Worksheet 4

Questions are provided in Worksheet 4 that allow the user to determine what infrastructure each sub-area needs. A separate Worksheet 4 should be used for each sub-area. Each answer on the worksheet is associated with a point value. Sum the point total and place that number in the indicated location. Transfer the totals to the appropriate place on the chart titled "Needs of Sub-Area". Shade in the bar chart provided for each category to determine if that mechanism is needed in a sub-area.

Use the steps outlined in Section V, Worksheet 5, "System Evaluation - Infrastructure Present," to locate existing solid waste infrastructure. The first step is learning what existing solid waste activities, capacities, fees, and services are currently provided or planned in and around your jurisdiction. This information will ensure the creation of a solid waste service that will be cost-competitive with alternative options. The price and convenience of other waste collection services will have a major impact on whether a significant number of customers from other areas will use your service. Knowing where legal MSW landfills and transfer station operations are available, their capacities, and what policies and fees they have for residential waste is important. The reasonable commuting distance for a citizen to a solid waste disposal facility is 10 miles. The reasonable commuting distance for a collection truck to a solid waste disposal or transfer facility is 25 miles.

Worksheet 5

Special service provider information may also be useful for waste collection service planning purposes. Some local entrepreneurs may be willing to accept tires, appliances, or used oil for recycling and make pickups from your collection station sites. Regional recycling collection and processing centers such as aluminum can recyclers can provide data on the fees they will pay per pound and whether they are willing to cover transport costs for large loads. This data can help assess how cost-effective recycling and other services will be.

After locating all existing solid waste infrastructure, use Worksheet 6 in Section V, "Additional Needs" to determine what additional mechanisms are needed. Comparing the results of Worksheets 4 and 5 gives the user a clear picture of what additions are needed to service the community. This exercise should result in a map showing the existing gaps in solid waste service and a general idea of what people are paying for collection and disposal services.

Worksheet 6

System Effectiveness

Determining effectiveness of an existing system is difficult to quantify because intangible variables such as public opinion, community benefits, and functionality are included. This assessment will therefore focus on the most tangible aspect of effectiveness, cost-per-capita. The intangible aspects should have an impact on the final decisions, but they can not be given a monetary value that will be equitable to all governments.

The cost-per-capita for the existing solid waste system can be calculated using Worksheet 7, "System Evaluation - Costs," in Section V. This is a tedious worksheet and will only provide results as accurate as the data used in the calculations. An alternative means of determining cost-per-capita is to use TNRCC's full cost accounting method workbook, which provides a very detailed analysis. Since TNRCC's full cost accounting method is so thorough, it is likely that the same results will not be found using Worksheet 7 and the TNRCC's full cost accounting method. However, the results should be within a reasonable percent deviation.

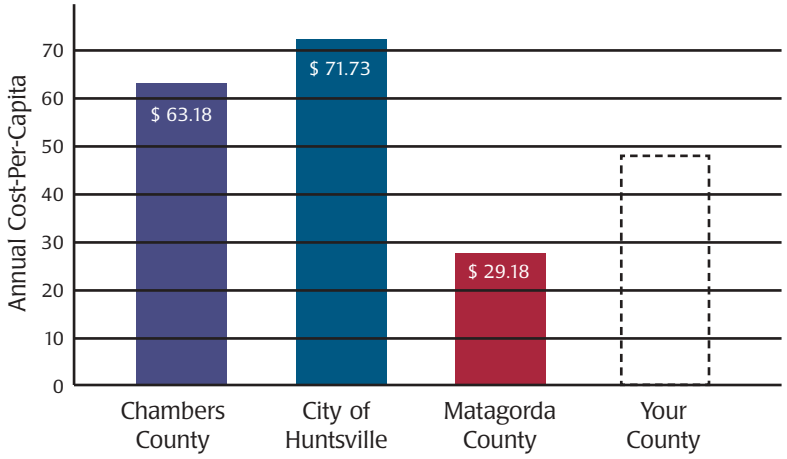
Worksheet 7

Worksheet 7 sums the existing solid waste expenditures by category so that a cost-per-capita of each service can be calculated, as well as a total service area cost-per-capita. These categorized figures will be used when evaluating the impact of system enhancements on total cost and total cost-per-capita.

Case Study Comparison

Now that an annual cost-per-capita has been determined for your area, compare it to the case study results shown in Figure 17.

Figure 17: Case Study Cost-Per-Capita Results for Comparison



Be sure to compare all aspects of the system. Use the checklist below (Figure 18) to ensure you have considered all variables.

Figure 18: Checklist of Variables for Comparing Solid Waste Systems

- √ Are the population densities similar?
- √ Is the population make-up similar?
- √ Is the population growth similar?
- √ Is the government type similar?
- √ Are services similar?
- √ Is the waste stream similar?
- √ Is the waste generation similar?
- √ Is the commitment to solid waste services similar?
- √ Are the regulatory requirements similar?
- √ Is the cost for services similar in my area?

Enhancement Options

This workbook is intended to promote the use of CCSs and transfer stations in rural communities. Therefore, although other alternatives will be mentioned, only CCSs and transfer stations will be discussed in-depth.

Administration

The administration of a solid waste program is very important. Chambers County and the City of Huntsville have been successful because an administrative person is dedicated to the program. Often solid waste is placed in the Environmental Health department and shares one person's time with all other environmental and health issues. A truly successful program will dedicate at least one full time employee to solid waste.

Illegal Dumping and Clean-Up Programs

Illegal dumping and clean-up programs are very important to educate the community in the proper means of disposal for solid waste. However, these programs can not be successful without providing convenient legal means of MSW disposal to citizens.

Reduction, Reuse, Recycling

Recycling programs also add great value to a solid waste program and can greatly reduce the volume of waste being disposed at a landfill, thereby reducing disposal costs. Areas with recycling programs in place have a solid foundation to expand into MSW collection. Areas that do not have a recycling program in place should focus on first offering legal means of MSW disposal, then expand to recycling.

Collection

Hauling services are offered by many municipalities, but traditionally are not offered by counties. Although hauling as a means of collection may be unattainable, CCSs and transfer stations can be installed to ease distances citizens must commute to an existing legal disposal facility.

CITIZENS COLLECTION STATION

Definition

A CCS is simply a location where residents can get rid of hard-to-dispose items. A wide spectrum of collection center designs are possible, depending on the materials accepted, location, number of residents using the facility, and funds available for construction and operation. These centers are suitable locations for recycling and brush disposal.

At their most basic level, CCSs are simply conveniently located places where residents can drop-off their trash at certain times of the day. These stations typically feature one or more movable trailer, dumpster, or roll-off bin to temporarily store and then transport the collected waste to a MSW landfill. Residents are often charged a fee per unit disposed.

CCSs can be either fixed or mobile. A fixed station is permanently located on a parcel of land and typically has some improvements to support the collection and disposal operations, such as fencing, lighting, a driveway, and an attendant's shed. Fixed collection stations can be relatively low cost operations with waste collection bins only or they can offer more extensive services, including recycling collection, used oil collection, household hazardous waste collection, and composting. However, as waste collection service options expand, so do program costs.

Mobile collection stations are collection vehicles that stop at a designated time to accept resident's trash at a particular location, such as a section of right-of-way along a commonly traveled road. Typically there are little or no improvements at the places where they stop to collect waste, other than a sign to designate the times for collection, acceptable materials, and to identify the location. Some mobile collection sites use all-weather surfacing so cars and trucks can make safe use of the station even in poor weather conditions. Although not as common, it is possible to offer many of the full-service options typically found at a fixed collection station at a mobile station.

A CCS service often uses a pay-as-you-throw (PAYT) approach to recover some of its program costs. Under a PAYT program, residents are charged a small fee for each unit disposed. This fee is usually either collected at the disposal site or verified by adhering a sticker to the trash bag to show proof of payment, or by requiring purchase and use of a specially marked trash bag of a pre-determined volume.

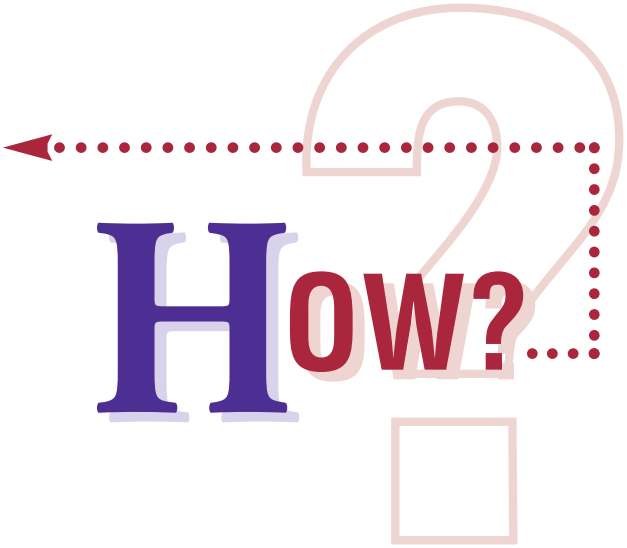
Planning

While there are a number of ways a jurisdiction could go about setting up a CCS, it is important to emphasize that a carefully conducted planning process is essential to avoid costly mistakes in the design and provision of MSW services. Before any planning can start, it is important to assign the responsibilities and timelines for the planning analysis to some individual or group. This can be performed by the public entity or contracted out to an engineering consulting firm that specializes in MSW management and planning. This workbook is intended to allow the public entity to perform the basic analysis without the assistance of a consulting firm. Regardless of the approach taken, it is important to emphasize that an open, public process is critical for successful implementation of the programs. Residents must feel that the proposed waste collection service will be of value to the community, and that it provides a truly affordable and convenient alternative to the current waste collection approach.

Location

CCSs should be located where there are concentrations of people that will not have to drive more than ten miles to dispose of their waste. They should be located in close proximity to frequently traveled roads so residents can complete multiple trip tasks including solid waste disposal. The location should also consider potential nuisance problems (odors and noise) or hazard problems (traffic or floodplain issues). Lastly, the location should be affordable and suitable to the design so that capital improvement costs can be minimized. Varying site selection criteria will be necessary depending upon the layout of the facility. Some areas may require larger pieces of land, larger buffer zones, larger distances from specifically zoned areas, or required distance for commute to a transfer station. CCSs should be carefully located to enhance their success. Typically a fixed CCS is constructed on less than one acre of land.

Design



Ideally, all CCSs will meet certain minimum standards to ensure user safety, convenient access, ease of use, control of litter, prevention of scavenging, and adequate waste collection service opportunities. However, because of the need to keep costs at a minimum for some facilities, not all of these can be implemented. The absolute minimum requirements for a convenience center are:

- All weather surfaces on the access road and on the site,
- Easy access for residents to the site and to the containers,
- A perimeter fence for security and wind blown materials control,
- Convenient hours of operation, including weekends,
- Posted signs that state the hours of operation, materials accepted, and a warning that illegal dumping violators will be prosecuted.

Additional recommendations for a safe effective operation are:

- Site layout that is easy for residents to use and easy for waste removal to occur,
- Landscaping along fence line to provide a visual buffer,
- Provide lighting for evening hours to discourage illegal dumping,
- Have an attendant on duty at all times while the station is open to assist residents, prevent stealing of recyclables, keep the site clean, and control the types of waste put into containers,
- Maintain the site so that nuisance conditions (odors, vectors, etc.) do not become problematic,
- Provide water, electric, and sewer utilities for site maintenance and attendant needs at all fixed sites,
- Have the ability to accept a wide variety of materials.

The design should allow residents to use the CCS easily and quickly. The primary factors in determining the layout of the CCS are the type of accepted material and containers required for storage. The size of containers is based on the daily volume and desired time cycle between removals.

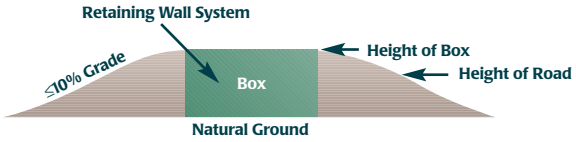
There are many different layout options for constructing a CCS drop-off area. Three of these options and the pros and cons associated with each are shown as Figure 19. Leachate collection systems should be included in CCS design. Any leachate generated by the facility should be properly collected and disposed of.

Figure 19: Options for Citizens Collection Station Drop-Off Areas

Option 1

Pros:
- Inexpensive construction
- Boxes are only pulled in one direction

Cons:
- Only one citizen can unload at a time, so cycle time of customers will be high



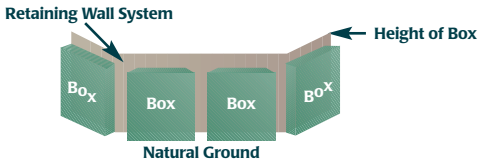
Profile

Plan

Option 2

Pros:
- Allows multiple users at one time
- Citizens can back up to boxes for easy unloading
- Accommodates large quantity of waste collection

Cons:
- Costly construction due to length of wall
- Boxes must be pulled from various orientations, but have option to eliminate boxes on wings



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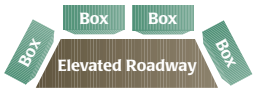
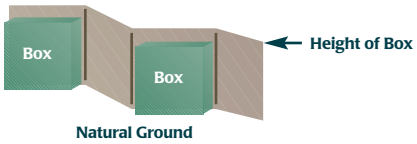


Plan

Option 3

Pros:
- Box removed in only one direction
- Citizens can back up to boxes for easy unloading
- Unloading can occur from 2 sides of box

Cons:
- Retaining wall can be costly due to length of wall



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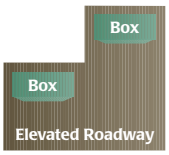


Plan

Operations

Generally operators of CCSs recommend that they be manned facilities, although un-manned stations are an option. Advantages and disadvantages of each are shown in Figure 20.

Figure 20: Advantages and Disadvantages of Manned and Un-Manned CCS.

	Advantages	Disadvantages
Un-Manned CCS	• Reduces roadside dumping • Places collection near most residents • Least expensive collection alternative to implement • Can provide a greater number of locations	• No control of the items left at the collection site • Scavenging, vandalism, and littering are prevalent • Requires separate location for hard-to-dispose of items
Manned CCS	• Reduces roadside dumping • Offers control over what is left at collection site • Provides a place for hard-to-dispose items • Allows for efficient use of collection vehicles • Prevents scavenging, vandalism, and littering	• Residents must travel further to dispose of waste • More expensive to construct and operate

Costs

Costs are a major factor when determining what CCS configuration will be sustainable for a community's needs. The cost of building and maintaining a CCS can be divided into capital costs and operating costs. Capital costs are the initial expenditures that will benefit the facility for one or more years beyond the purchase year. Annual operating costs are continual costs to operate and maintain the facility. Accrued costs to replace capital items are also included in annual operating costs. Local government budget officials, engineers, and auditors should be able to aid decision-makers in generating plausible estimates for each CCS scenario under consideration. Figure 21 provides a general breakdown of capital and operating costs.

Figure 21: Distinction Between Capital and Operating Cost

Capital Costs	Operating Costs
• Acquisition and Preparation of Site • Purchase of Equipment	• Replacing capital equipment as needed • Depreciation costs associated with capital items • Costs associated with daily operation of facility

There are many options that can be incorporated into a CCS to make it as elaborate as is desired by the community. Potential capital items for a CCS and the estimated cost of each are shown in Table 27. Capital costs will vary depending on the facility design and the market for items in the region. Capital costs can be as low as $20,000 for a mobile collection trailer station that stops next to a county highway, or as high as $100,000 for a full service CCS that includes a recycling program. The figures provided in Table 27 are meant to serve as a guideline.

If a community decides to proceed with the implementation of a CCS, more specific regional estimates should be generated. An important consideration in estimating capital equipment costs and locating equipment is the impact of the purchase and operation of this capital equipment on community compliance with applicable Texas and federal laws and regulations. For example, the Texas Department of Transportation applies federal standards to the operation of heavy equipment, such as large haul trucks, that may restrict the movement of these vehicles across certain bridges and roads. It is important for community leaders to become familiar with local, state, and federal standards applicable to their service area before settling on specific waste collection and transport equipment.

Table 27: Possible Capital Items for Development Of a CCS and Estimated Cost of Each

(Source: "A Guidebook for Community Convenience Centers: One Solution to Illegal Roadside Dumping" Oklahoma Agricultural Experiment Station)

Site	Estimated Cost
Land	varies by local market
Ramp and Retaining Wall	$25,000-35,000
Building	$35/square foot
Fencing	$10-12/linear foot
Ranch Style Fencing	$2/linear foot
Land Covering	varies by local market
Paving Options:	
Crushed Rock	$0.175/square foot (based on $8.25/ton delivered price)
Asphalt	$1/square foot
Concrete	$2.50/square foot
Signage	$50-200

Equipment	Estimated Cost
Collection Trailers	$3,000
Dumpsters (or Green Boxes)	$450-600
Open Top Roll-Off Boxes	
20 yard	$2,500-2,600
30 yard	$2,600-3,000
40 yard	$3,200-3,500
Closed Top Roll-Off Boxes	
40 yard	$4,250-6,400
Stationary Compactor	
2 cubic yard	$6,000-9,000
3 cubic yard	$10,000-14,000
Pickup Trucks	$16,000-18,000
One Ton Collection Truck (14 cyd.)	$28,000
Roll Off Truck	
Hoist only	$15,000-23,000
Truck and Hoist	$60,000-83,000
Truck Scale	$35,000-55,000

Recycling and Brush Equipment	
Chipper/Shredder	$20,000-25,000
Partitioned Containers	
26 cubic yard, 4 door	$3,500-4,500
Trailer Mounted	$9,000-11,000
Baler	$4,000-5,500
Hand Scale	$500-1,200
Antifreeze and Oil Container	typically provided at no cost to recycler
Can Crusher	typically provided at no cost to recycler

The estimated cost for installation of a simple small CCS and a more elaborate larger CCS are shown in Table 28. Diagrams of the layout of a simple CCS and an elaborate CCS are shown as Figures 22 and 23.

Table 28: Simple and Elaborate CCS Estimated Capital Cost

(Data interpolated from "Roadside Dumping: Possible Solutions" by Sloggett, Goodwin, Deokson and Fitzgibbon)

	Simple	Elaborate
Site Development for Household Solid Waste Collection	$ 30,000	$ 75,000
Site Development for Other Solid Waste Collection	$5,000	20,000
Large Containers	(1) - 2,500 (2) - 3,500	(1) - 2,500 (4) - 3,500
Collection Truck	60,000	80,000
Other Equipment	2,000	25,000
Totals	**$ 106,500**	**$ 216,500**

Figure 22: Simple CCS Layout

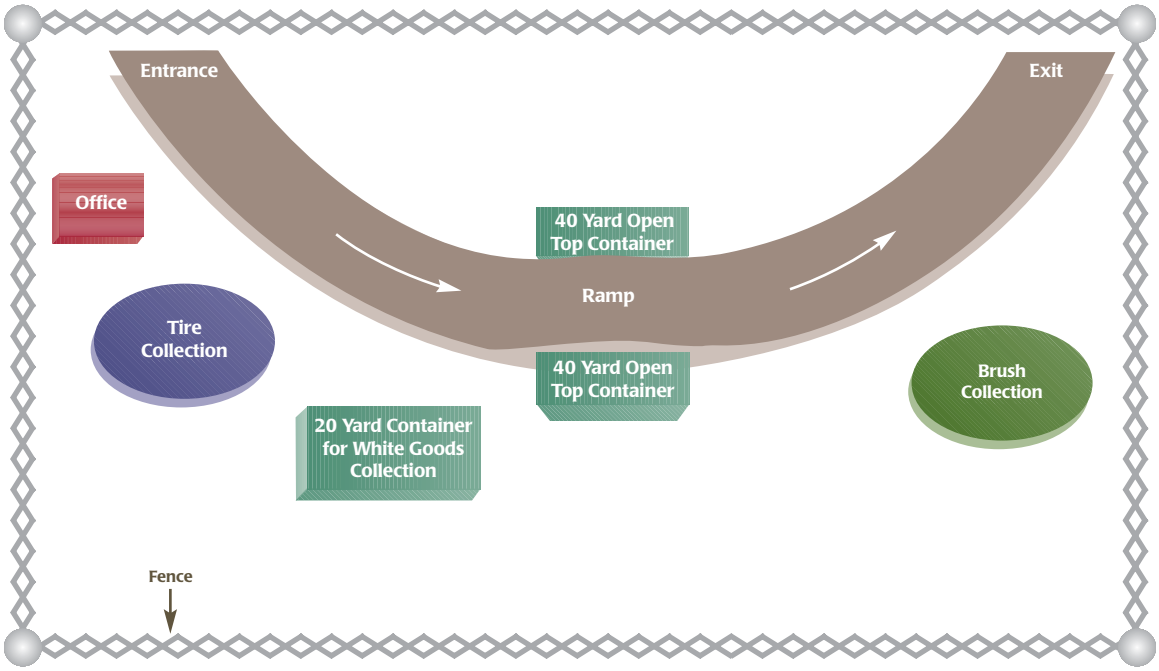
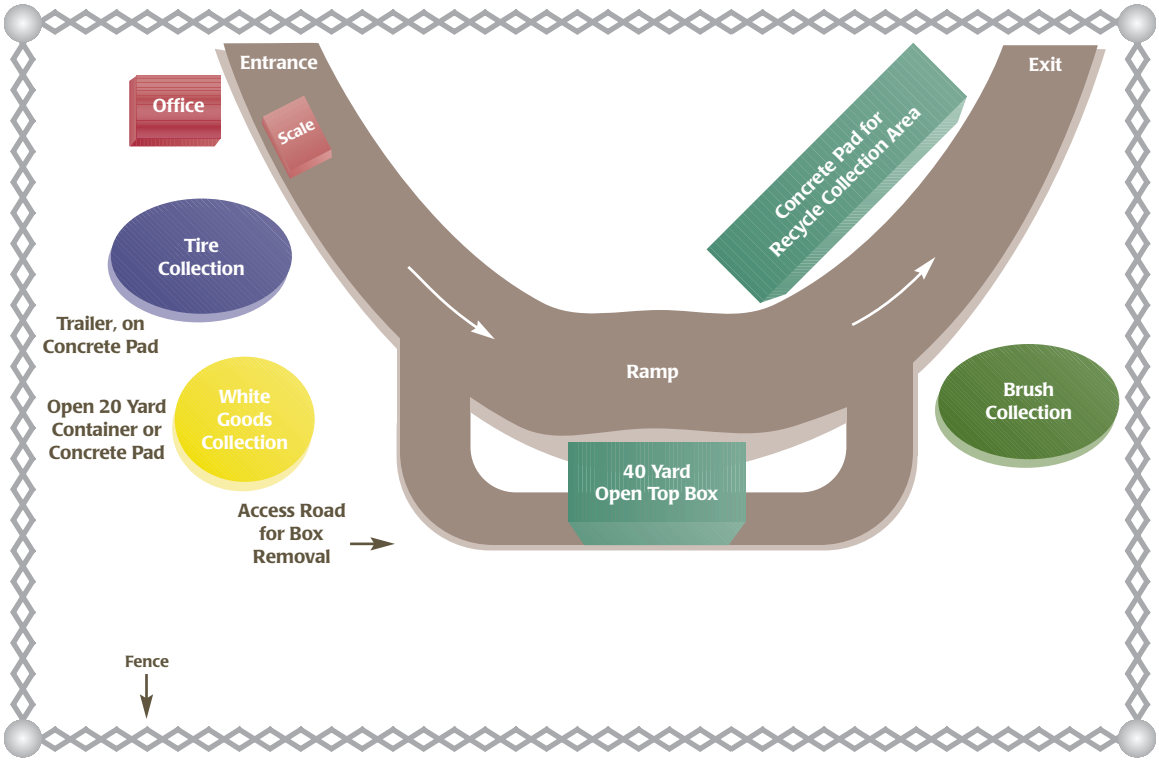


Figure 23: Elaborate CCS Layout



To determine annual capital costs, the life cycle of each piece of equipment must be assumed. The depreciation value can then be determined using a simple straight-line depreciation. The initial cost of the equipment divided by the expected life give the annual depreciation amount for that piece of equipment. Assumed life periods for CCS equipment is shown below in Table 29.

Transfer trucks and roll-off trucks are not included in this chart because their life spans are not calculated on a yearly basis, but rather on a mileage basis. Trucks typically can accumulate 200,000 miles before being replaced. Determine the expected annual mileage of the truck and divide that by 200,000. This will yield the expected life span of the truck.

Table 29: Useful Life of Capital Items in a CCS

(Source: "A Guidebook for Rural Solid Waste Management Services," Southern Rural Development Center, 1993)

Capital Term	Useful Life in Years
Ramp and Retaining Wall	25
Building	25
Fencing	10
Crushed Rock	5
Asphalt	10
Concrete	25
Green Boxes - Dumpsters	5
Roll-Off Containers	10
Roll-Off Hoist	10
Stationary Compactor	10
Chipper/Shredder	10
Hand Scale	25
Truck Scale	15

Operating expenses can be calculated using Table 30, which provides guidelines for determining expenses that may be encountered in operating a CCS.

Table 30: Operating Expenses Of A CCS

(Source: "A Guidebook for Community Convenience Centers: One Solution to Illegal Roadside Dumping")

Attendant	$6/hour
Fringe Benefits	30% of Labor
Utilities	$100-300/month
Fuel for Truck	$0.125/mile (assume 8 mpg and $1/gallon fuel cost)
Maintenance for Truck	$0.35/mile
Miscellaneous	$1,200 per year
Tipping Fees	Varies depending on area

Fees

So, how do you determine what citizens will pay to legally dispose of their waste at a CCS? Fees can be voluntary, as in the case of Matagorda County, or mandatory, as in the case of Huntsville. Or they can be free, as in the case of Chambers County. Most areas do not have the ability to offer free solid waste services, so they must construct a fee schedule that meets the needs of their community.

The most accurate method of determining what people are willing to pay is to conduct a survey, asking residents what they would be willing to pay for a convenient disposal option. For a voluntary system, a fine balance must be achieved between the participation rate and the user fee. As the user fee increases, participation rates will decrease, and vice versa. Higher user fees will produce low participation rates and yield low overall revenues. The ideal user fee lies somewhere in between. Someone who can gauge what the citizens are willing to pay must determine this amount.

Implementing a mandatory system will guarantee high participation rates, but may have a negative impact on the community's reception of the new service. The chosen rate will never please all citizens, but the target should be to offer a break-even system that provides citizens with the best possible service.

Worksheet 8, "Cost of Adding a Citizens Collection Station" in Section V, provides a guideline for determining the cost to construct and operate a CCS. There are many decisions that must be made before determining how much your convenience center will cost to initiate and operate. Before progressing in your cost analysis, answer the following questions:

Worksheet 8

Demographics

- Who will the users of the CCS be?

Infrastructure

- Where will the CCS be located?
- What services will the CCS offer - recycling, diversion of materials that could easily be composted or recycled (such as white goods), separation of Type I and Type IV wastes, or the collection of used oil, used oil filters, antifreeze, and used tires.
- How will the site by laid out and what style of collection station is most beneficial to the users of the facility?

Costs

- Will the citizens be charged for disposing of materials at this facility? If so, how will the fees be structured (weight or volume or per item) and what will they be dependent upon?
- How will the facility ensure that only specified people are using the facility?
- Will there be employees at this facility? (Most existing CCS operators encourage manned facilities to ensure the continued cleanliness of the facility and to prevent dumping of materials that aren't allowed.)
- Who will be responsible for maintaining and operating the CCS?
- What volume of material is the CCS expected to receive?
- Will the collection station accept only loose materials or will a compaction system be in place?

Many of these topics have been discussed earlier in the workbook. Volume and cost data can be obtained from the worksheets in Section V and the text in Section IV: Citizens Collection Stations.

Worksheet 9

The last step before determining if a CCS would be beneficial to the community is to determine what existing solid waste expenditures would be eliminated with the addition of a CCS. This can be calculated using Worksheet 9, "Cost Averted With the Addition of a CCS" in Section V.

Regulations

According to 30 TAC 330.4(f), a permit or registration is not required for a facility or site that is used as a CCS. However, 30 TAC 330.24 does require that:

Citizens collection stations shall be provided with the type and quantity of containers compatible with the areas to be served. Rules shall be posted governing the use of the facility to include who may use it, what may or may not be deposited, etc. The responsible private contractor or any other party, which owns or operates the collection center shall provide for the collection of deposited waste on a scheduled basis and supervise the facility in order to maintain it in a sanitary condition.

TRANSFER STATIONS

Definition

Transfer stations are a more advanced mechanism for areas with larger daily volumes being transported more than 25 miles one-way for disposal.

A transfer station is a facility where waste is collected and then transferred to a disposal site. Typically, collection vehicles unload on an elevated tipping floor above open top transfer trailers that are loaded in the lower level tunnel area. Sometimes the waste is unloaded from the collection vehicle through a hopper directly into a transfer trailer. Other designs require the use of a large wheel loader to push the waste into the transfer trailer below. The clearance between the bottom of the hopper and the top of the transfer trailer is very minimal and must be sealed to keep the waste from being blown out of the trailer during loading. Rural transfer stations generally have a stationary knuckle boom that both compacts the waste in the transfer trailer and assists in loading it. A scale can be provided on the lower level to determine when the maximum weight of the trailer has been reached. However, rural transfer stations typically use their tipping fee scales to verify weights before leaving the facility.

Transfer stations can be even simpler systems, known as mobile transfer stations. These require nothing more than a pad and leachate containment system. Collection vehicles pull up and transfer their loads directly into a trailer. The waste never hits the ground, eliminating the extra handling. Trailer hydraulics compact the waste, providing room for two to three collection vehicle loads before the transfer rig is full. Some trailers feature expanding sidewalls so that waste collection trucks can empty their loads directly into the trailer. These mobile transfer stations, or route stations, can be built for significantly less than a traditional transfer station ($5,000 to $50,000).

Transfer stations can also be expanded to include elaborate technological systems. An example of a highly technical and very effective system can be found in Cass County, Texas. This 35,000-person county operates a transfer station/material recovery facility (MRF) that only disposes of 13% of the incoming waste. This has reduced trips to the nearest landfill, 51 miles away, to one trip per week. Incoming waste is dumped onto a tipping floor where two front-end loaders dump it into a pit, where it falls on conveyors and makes its way through a series of machines. The first machine tears the garbage bags open, and then a track sorter removes the fines, which fall through a screen. The ferrous materials are retrieved with magnets. The remaining materials travel down conveyor belts where they are hand sorted into 15 different categories. The materials removed in this stage are dropped onto a conveyor below where they are packaged for recycling. Once all has been picked from the lines, the remaining waste material is sent through a grinder and made into fuel cubes which are sold to a plywood plant to power their industrial boiler. Even with all of this recycling and labor supplied by the local jail, the facility does not quite break even. However, Cass County focuses on the fact that their aggressive materials recovery saves the much higher capital costs associated with a landfill.

Transfer stations typically operate on a pay-as-you-throw (PAYT) system where a fee is charged per ton or cubic yard of material disposed. Some customers may establish accounts with the transfer station, but fees are based on volume entering the transfer station.

Planning

While there are a number of ways to implement a transfer station, it is important to emphasize that a carefully conducted planning process is essential to avoid costly mistakes in the design and provision of MSW services. Before any planning can start, it is important to assign the responsibilities and timelines for the planning analysis to some individual or group. This can be performed by the public entity or contracted out to an engineering consulting firm that specializes in MSW management and planning. This workbook is intended to allow the public entity to perform the basic analysis without the assistance of a consulting firm. However, a transfer station registration and design will require the assistance of a licensed Professional Engineer.

Regardless of the approach taken, it is important to emphasize that an open, public process is critical for successful implementation of the programs. Residents must feel that the proposed waste collection service will be of value to the community, and that it provides a truly affordable and convenient alternative to the current waste collection approach.

Several factors must be considered when designing a transfer station. These include site selection, waste quantity, waste characteristics, site layout, construction and design features, environmental factors, recycling, and future expansion. Making decisions related to these issues in the planning phase can eliminate costly and timely delays during design and construction.

Before implementing a transfer station, the costs must be compared with the cost of direct haul. Depending on tonnage and traffic conditions, it is often less costly to direct haul up to 25 miles in lieu of constructing a transfer station. Beyond that distance, many analysts have determined that the combination of transit time and vehicle wear favor transfer.

Location

Site selection entails evaluating available pieces of property to determine which is best suited for a transfer station serving the community. The primary factors to consider are location with respect to waste source, size and configuration of property, site conditions, property cost, required permits, zoning restrictions, and land use compatibility.

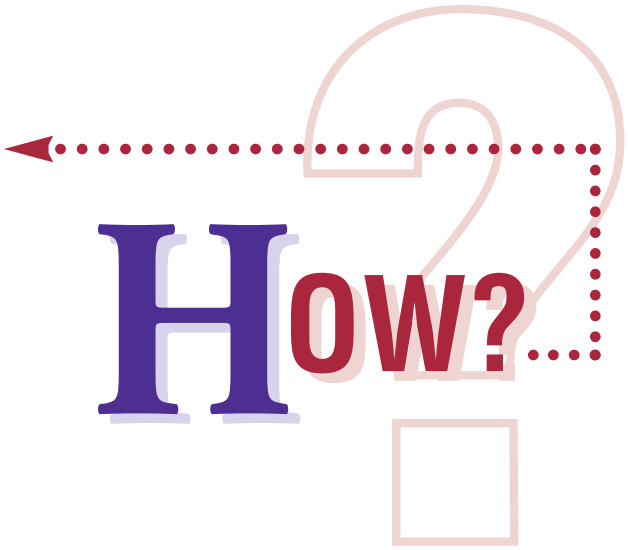
Locating the transfer station close to the center of the service area provides maximum efficiency. Geography, demographics, and the position in relation to the waste source and destination are initial considerations. Current and future population distribution, available land use, future land use, and transportation routes are important siting criteria. The route that will be used to reach the facility must also be examined to ensure that roads can handle the weight of a loaded transfer trailer. Locating the facility close to a major roadway is best.

The shape of the property, required setbacks, existing easements, stormwater management requirements, landscaping requirements, and flood plain or wetlands areas could elevate the amount of acreage needed for the transfer station. Generally two to three acres will be enough property. A rectangular site is best suited for a transfer station; however, each facility should carefully examine their needs before ruling out properties that have varying shapes. A site with varying elevation is preferred, since most transfer stations are two level structures. Setback requirements vary depending upon the agency regulating the transfer facility. Permitted or registered transfer facilities in Texas must maintain a 50-foot buffer zone per 30 TAC 330.121(b). A local authority generally determines easement requirements, zoning issues, stormwater management, and flood plain requirements. In Texas, the Corps of Engineers regulates wetland issues. A person knowledgeable in local, state, and federal environmental regulations should be consulted prior to selecting a site.

The availability of water, electricity, telephone, and sewer service at the property will reduce costs of constructing the facility. If sewer service is not available, other means of handling leachate created by the facility must be developed. Trucking of leachate and other handling issues can create costly operating expenses. In most cases, leachate generated at transfer stations can be discharged into the sanitary sewer with little or no pre-treatment. Water is needed to wash the tipping floor and maintain a clean facility. The cleanliness of the facility will reduce potential odors at the transfer station.

Be sure to consider the public relations impacts of siting the new facility. Local opposition to waste handling facilities can be extensive. Locating a site where a completely enclosed facility can be constructed will reduce odor and visual opposition. A site surrounded by trees gives a natural buffer to the surrounding community.

Design



Using existing facilities and infrastructure, such as an industrial warehouse or other large structure, can reduce capital costs. Properties might be available that already contain the type of building needed for the transfer station. There are several considerations that will ensure the compatibility of an existing building with the requirements of the new transfer station. The grade separation between the two levels is typically 15 to 18 feet. The tipping floor area ceiling height must allow enough clearance for the tipped collection vehicle to maneuver while unloading. The tipping floor must be large enough to allow for easy interception and removal of hazardous waste or the control of hot loads. Roadway slopes for transfer trailers and collection vehicles should not exceed 10 degrees. The turning radius needed for a large transfer trailer is 75 feet, whereas a radius of 50 feet is adequate for most other vehicles.

The most important consideration when developing plans for a transfer station is the quantity of waste that the facility will be designed for. The average waste generation of the service area and the peak rate must be determined. Keep in mind that waste generation experiences seasonal variations that can heavily impact the peak rates.

The types of vehicles that will be using the facility can have a large impact on the cycle time of the facility. The cycle time is an important factor in determining the flow rate of users at the facility. Generally a compactor vehicle can unload 10 tons in a maximum of five minutes. However, a citizen with a trailer loaded with less than 1 ton of material generally takes a minimum of 20 minutes. Understanding who will be using the transfer facility allows for better assumptions of the space needed at peak times, and results in a better design.

A transfer facility may include a separate facility for self-hauled materials, a white goods collection area, a recycle collection area, a household hazardous waste collection area, tire collection, brush collection for composting, scales, a scale house, a fueling facility, a maintenance facility, a vehicle wash area, and/or a transfer vehicle parking area. To the extent possible, transfer stations are designed for counter-clockwise, one-way traffic flow. Counter clockwise movement allows better visibility for both forward and backward movement. One way traffic reduces the need for turning lanes, queuing space, and the hazard caused by vehicles crossing each other's paths. Separating large collection vehicles and self-haul customers also reduces potential hazards caused by the interaction of the public with heavy equipment. Providing separate areas will have an impact on the layout and design of the facility.

Operations

Facilitating movement in and out of the facility, allowing for separation and temporary storage of materials, and providing for the future will impact operational costs. The key to designing a successful transfer station is flexibility. The most cost-effective operation should be determined, evaluating the distances, waste composition, and tonnage involved. The site should be designed for these criteria, but the transfer station design must allow for future expansion of the facility. To control capital costs, plan the initial design based on a 10-15 year period. In the future the facility can be expanded, or the operating hours can simply be extended.

Costs

Since collection costs are generally twice as much as disposal costs, communities are finding it necessary to collect and transfer waste as efficiently as possible. Convenient and efficient, transfer stations are useful in providing a more economical haul to more distant sites.

Transfer stations in rural communities are designed for a small amount of waste transferring capacity (less than 325 tons per day). A typical rural transfer station layout is provided as Figure 24. Capital costs for this typical rural transfer station are shown in Table 31. Annual operating and capital costs for this typical rural transfer station are shown in Table 32. Annual capital costs are items that will require replacement on a regular basis or known maintenance on vehicles. The costs of building and maintaining a transfer station can be divided into capital costs and operating costs. Capital costs are the initial expenditures that will benefit the facility for one or more years beyond the purchase year. Annual operating costs are continual costs to operate and maintain the facility. Accrued costs to replace capital items are also included in annual operating costs. Local government budget officials, engineers, and auditors should be able to aid decision-makers in generating plausible estimates for each transfer station scenario under consideration.

Figure 24: Typical Rural Transfer Station Layout

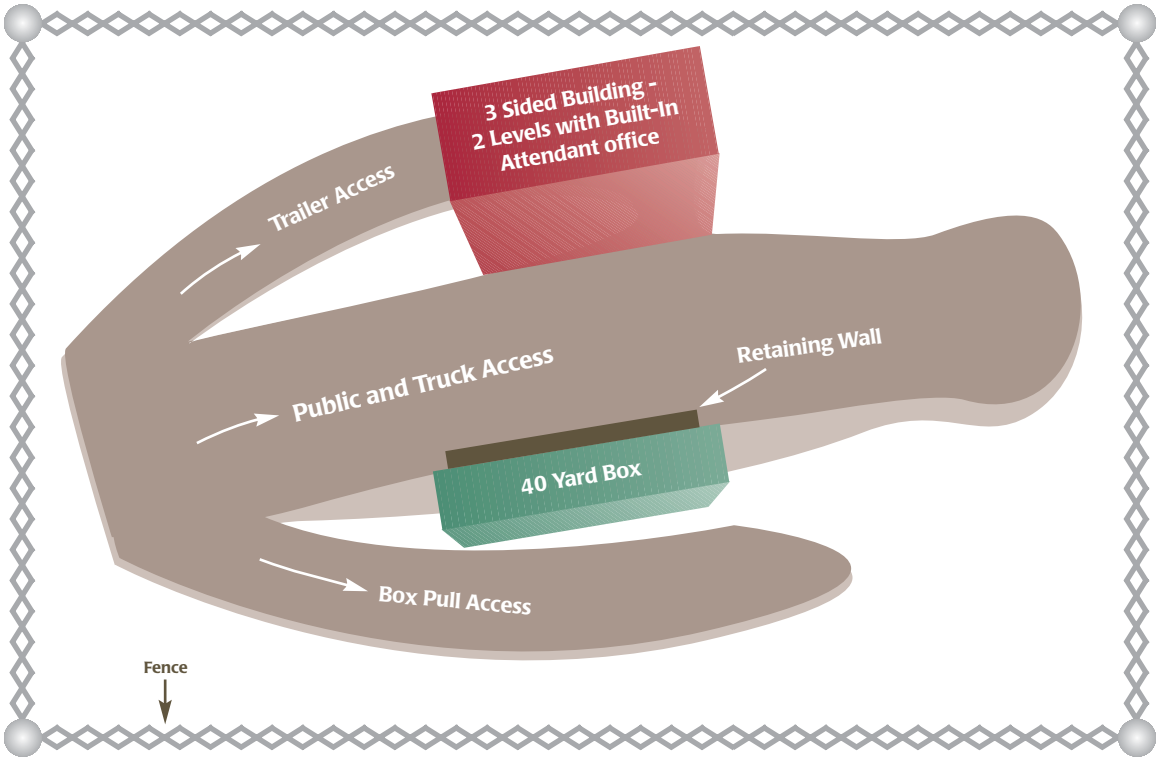


Table 31: Estimated Rural Transfer Station Capital Costs

(Source: "Solid Waste Transfer Stations for Rural Oklahoma" by Sloggett, Deokson and Fitzgibbon)

Item		Cost (Dollars)
Land	$	4,000
Building		80,000
Ramp and Wall		20,000
Crushed Rock		16,500
Fence		20,500
Concrete and Foundation		220,000
Semi-Truck and Trailer		150,000
Engineering		20,000
Contingency (~ 10%)		50,000
Total Capital Cost	**$**	**581,000**

Table 32: Estimated Rural Transfer Station Annual Capital and Operating Costs

(Source: "Solid Waste Transfer Stations for Rural Oklahoma" by Sloggett, Deokson and Fitzgibbon)

Item		Cost (Dollars)
Annual Capital Costs		
Building	$	2,100
Ramp and Wall		800
Crushed Rock		3,000
Fence		1,000
Concrete Repairs		15,000
Depreciation Expense		25,000
Subtotal	**$**	**46,900**
Annual Operating Costs		
Fuel and Maintenance (@ 75,000 miles per year)	$	75,000
Station Attendant (@ $6 per hour - 40 hours per week)		12,400
Driver (@ $12 per hour - 40 hours per week)		24,960
Fringe Benefits (@ 30%)		11,232
Tipping Fees (50 tons per day @ $28 per ton)		364,000
Contingency (~ 10%)		50,000
Subtotal		537,672
Total Annual Costs	**$**	**584,572**

Worksheet 10, "Cost of Adding a Transfer Station" in Section V, provides a guideline for determining the cost to construct and operate a transfer station. There are many decisions that must be made before determining how much your transfer station will cost to initiate and operate. Before progressing in your cost analysis, answer the following questions:

Worksheet 10

Demographics

- Who will the users of the transfer station be?

Infrastructure

- Where will the transfer station be located?
- What services will the transfer station offer - recycling, diversion of materials that could easily be composted or recycled (such as white goods), separation of Type I and Type IV wastes, collection of used oil, used oil filter, antifreeze, collection of used tires.
- How will the site by laid out and what style of collection is most beneficial to the users of the facility?

Costs

- Will the local citizens be charged for disposing of materials at this facility? If so, how will the fees be structured (weight or volume or per item) and what will they be dependent upon? How will the fees be structured for commercial customers?
- How will the facility ensure that only specified people are using the facility? Or does it matter who uses the facility?
- How many employees will there be at this facility?
- Who will be responsible for maintaining and operating the transfer station?
- What volume of material is the transfer station expected to receive?
- Will the transfer station accept only loose materials, or will compacted material be accepted at a varying fee level?

Many of these topics have been discussed earlier in the workbook. Volume and cost data can be obtained from the worksheets in Section V and the text in Section IV: Transfer Stations.

The last step before determining if a transfer station would be beneficial to the community is to determine what existing solid waste expenditures would be eliminated with the addition of a transfer station. This can be calculated using Worksheet 11, "Cost Averted With the Addition of a Transfer Station" in Section V.

Worksheet 11

Regulatory Requirements

Currently, transfer stations that serve municipalities with populations less than 50,000 or counties with populations less than 85,000, or that transfer less than 125 tons per day, do not require a permit, but must be registered with the TNRCC, according to 30 TAC 330.4(d). If a transfer station includes a material recovery facility (MRF), a permit is not required according to 30 TAC 330.4(q) if the design criteria are met in accordance with 30 TAC 330.65(f). Site location criteria require that the transfer station be located more than 1.8 miles from any residence, school, church, or recreation area, not be located in any 100-year floodplain or in a wetland, and maintain a minimum setback distance of 75 feet between the process area and the facility property line. The distance from structures shall be considered to be those distances from structures in place at the time the application was submitted and is the distance between the facility property line and the structure.

Facility design capacity for registration in lieu of a permit must be less than a maximum of 325 tons per day. The facility must recover 10% or more of the total incoming non-segregated waste stream for reuse or recycling. The facility must also demonstrate that it will transfer the remaining non-recyclable waste to a permitted landfill not more than 50 miles from the facility. Facilities exempted from a permit under this subsection shall be registered with the executive director in accordance with 30 TAC 330.65. Otherwise a permit will be required for the transfer station.

Disposal

Landfilling and incineration are also options available to governments. However, the enormous costs involved only make them viable solutions when undertaken on a regional basis through partnerships. Even then it is necessary to utilize CCSs and transfer stations to cost-effectively transfer waste to the disposal facility.

System Re-evaluation

Now that all the data has been collected and the necessary information has been calculated, a system re-evaluation is needed. Figure 25 provides a flow chart delineating the process of evaluating the addition of a CCS to an existing solid waste system. Figure 26 provides a similar flow chart delineating the process of evaluating the addition of a transfer station to an existing solid waste system. Completing the exercise in these flowcharts will provide a quantitative recommendation for enhancements of the existing solid waste system.

Figure 25: System Re-Evaluation for Addition of a CCS

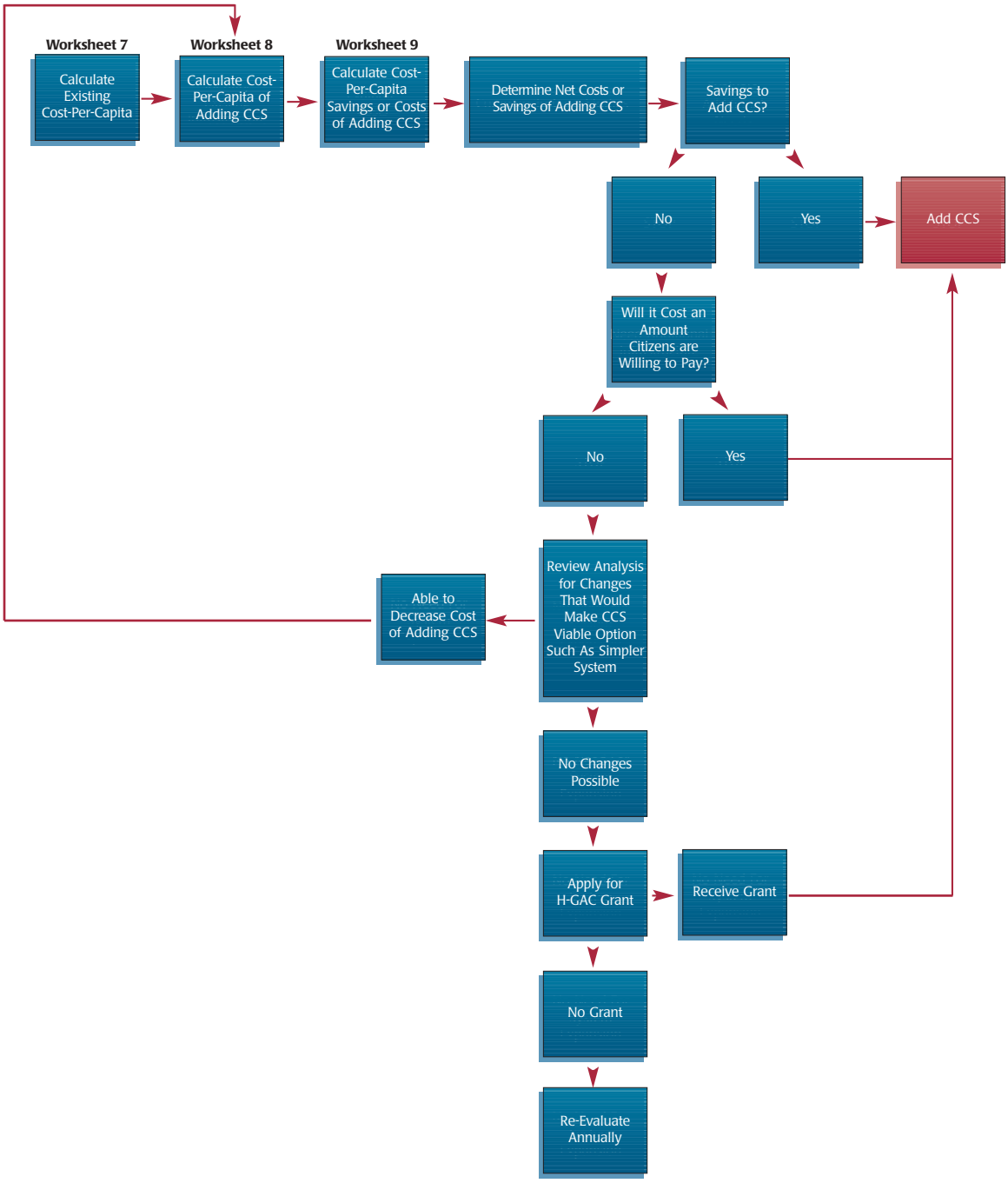
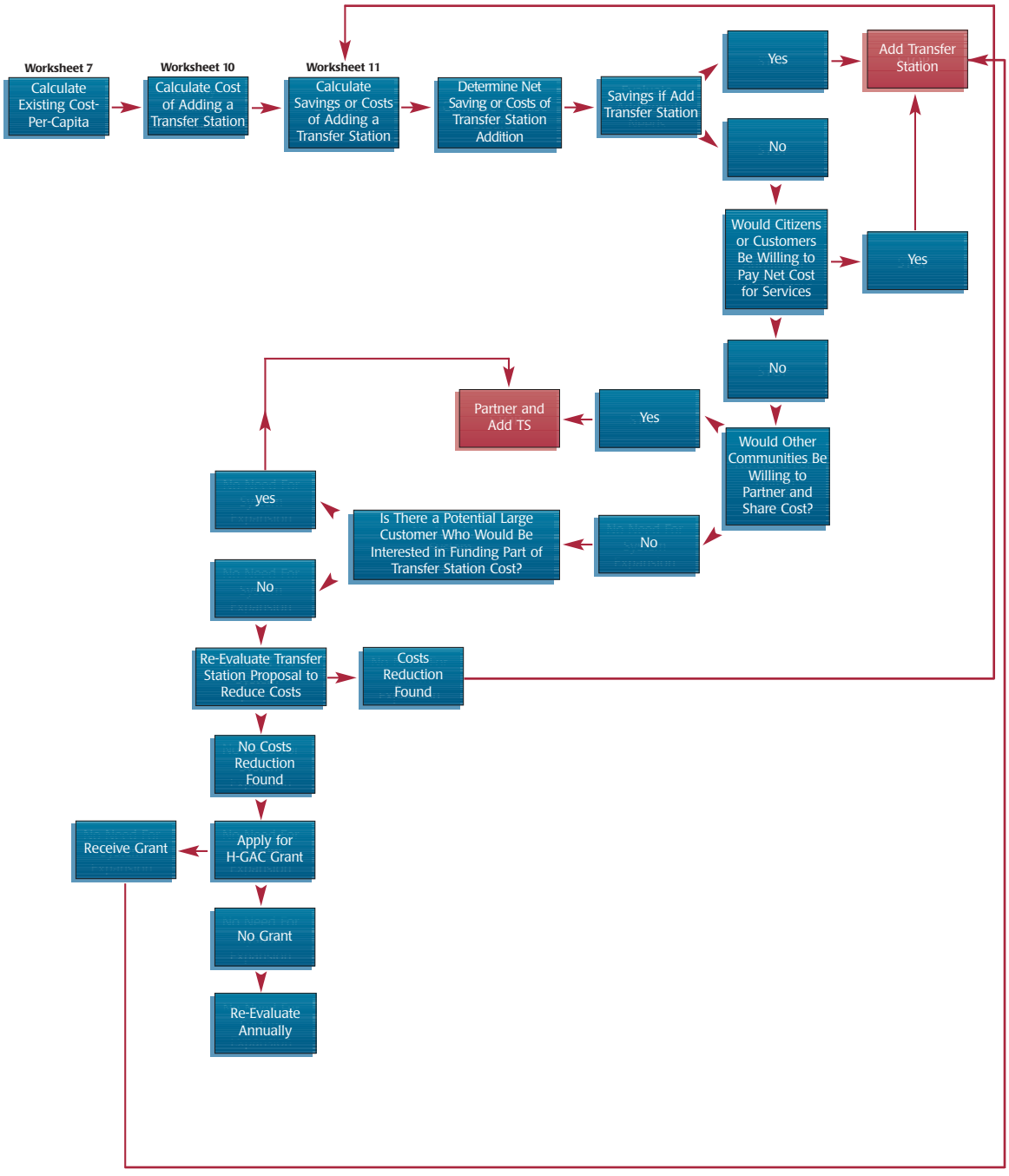


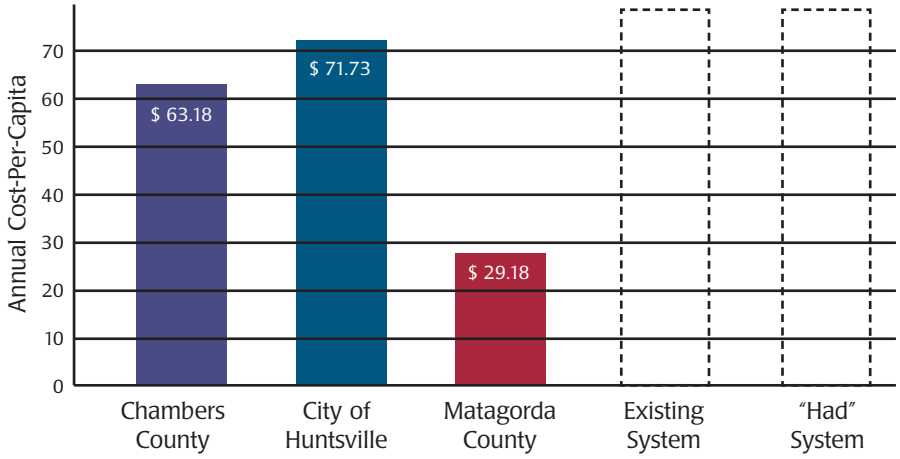
Figure 26: System Re-Evaluation for Addition of a Transfer Station



However, the re-evaluation can not end here. The effectiveness of the system and expected public opinion are equally as important as cost-effectiveness because they determine whether customers will actually use the facility. Therefore, if the proposed CCS or transfer station would effectively serve the community, the public is excited about the new facility, and it is cost-effective then it should be added. However, if there are issues to resolve, this must occur before moving forward with the new facility.

As a final comparison, re-evaluate the "new" solid waste system using Worksheet 7 in Section V. Then compare the old cost-per-capita, the "new" cost-per-capita, and the case study results using the bar chart provided as Figure 27.

Figure 27. Re-Evaluation Comparison



V. EVALUATION WORKSHEETS

Worksheet 1

Total Solid Waste System Demographics

This worksheet delineates a total service area, then divides it into sub-areas. These sub-areas are relatively highly populated, but manageable areas where solid waste services would enhance the community. Detailed directions for completing this worksheet are given below.

Line 1: **Population of Area** - Place the total population of the solid waste coverage area in this line. County and city population information can be obtained from H-GAC if it is not readily available at the county or city offices.

Line 2: **Number of Population Sub-Areas** - Using a census map of the coverage area, divide the overall area into sub-areas based upon population. The following steps should assist in this process.

Step 1: Locate areas of large population clusters (areas with a population greater than approximately 10% of the total population) and mark them on the map, outlining the boundary of the general area.

Step 2: Expand these sub-areas to include the spaces between the population sub-areas. For example, if there are two sub-areas with four miles of area in-between them, expand each of the sub-areas to include the two additional miles closest to them.

Step 3: Determine the total number of sub-areas and place that number in Line 2. There should not be more than ten sub-areas.

Line 3: **Population of Each Sub-Area** - Determine the total population within each sub-area. This can be accomplished by using city population data or census maps. Place the population sub-areas in the spaces provided in Line 3. Total the populations listed in Sub-Areas 1 through 10 and confirm that this total is equivalent to Line 1.

Line 4: **Percentage of Total Population in Each Sub-Area** - For each of the sub-areas listed in Line 3, perform the following percent population calculation and place the results in the respective sub-area section of Line 4.

$$\text{Sub-Area as \% of Total Area} = \frac{\text{Population of Sub-Area (Line 3)}}{\text{Total Population (Line 1)}} \times 100$$

Line 5: **Rank Sub-Areas by Percentages of Total Population** - Using the results obtained in Line 4, rank the percentages from highest to lowest in Line 5.

Worksheet 1

Demographics Of Coverage Area

Line 1: Population of Area _____

Line 2: Number of Population Sub-Areas _____

Line 3: Population of Each Sub-Area

- Sub-Area 1 _____
- Sub-Area 2 _____
- Sub-Area 3 _____
- Sub-Area 4 _____
- Sub-Area 5 _____
- Sub-Area 6 _____
- Sub-Area 7 _____
- Sub-Area 8 _____
- Sub-Area 9 _____
- Sub-Area 10 _____
- **Total (Should Equal Line 1)** _____

Line 4: Percentage of Total Population in Each Sub-Area

- Sub-Area 1 _____
- Sub-Area 2 _____
- Sub-Area 3 _____
- Sub-Area 4 _____
- Sub-Area 5 _____
- Sub-Area 6 _____
- Sub-Area 7 _____
- Sub-Area 8 _____
- Sub-Area 9 _____
- Sub-Area 10 _____
- **Total (Should Equal 1 or 100%)** _____

Line 5: Rank Sub-Areas by Percentages of Total Population

- Sub-Area (Highest %) _____
- Sub-Area _____
- Sub-Area _____
- Sub-Area _____
- Sub-Area _____
- Sub-Area _____
- Sub-Area _____
- Sub-Area _____
- Sub-Area _____
- Sub-Area (Lowest %) _____

Worksheet 2

Waste Stream Of Sub-Areas

This worksheet provides a step-by-step approach to determining the average solid waste disposal volume generated by each sub-area. This volume will be used in determining which services a community should support and in designing those systems.

Fill in the boxes for each sub-area, progressing from column A to O. Formulas for the boxes requiring a calculation are provided under the headings. More detailed instructions can be found in Section IV: Waste Generation and Waste Stream.

Waste Stream Of Sub-Areas (Per Day)

Worksheet 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Sub-Area	Estimated Population	Estimated Population from Other Areas	Total Serviced Population	Average Disposal (Lbs./ Capita)*	Estimated Volume (Lbs.)	Estimated Volume (Tons)	% Recycling Reduction	% Non-Participation Rate	Estimated Disposal Volume (Tons)	Peaking Factor	Volume During Peak Times (Tons)	Estimated Average Disposal Volume (Comp. Cubic Yards)	Estimated Average Disposal Volume (Loose Cubic Yards)	Estimated Peak Disposal Volume (Comp. Cubic Yards)	Estimated Peak Disposal Volume (Loose Cubic Yards)
Formulas					C x D	E/2000			F x (1-G-H)		I x J	1/0.333	1/0.2	K/0.333	K/0.2
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															

Worksheet 3

Annual Waste Stream Projections (Tons)

This worksheet converts the volumes calculated in Column I of Worksheet 2 from daily volumes to weekly, monthly, and annual volumes. Once the annual average volume is determined for each sub-area, 15-year projections can be made.

Calculations for conversions to varying time periods are provided below. A sample projection calculation is shown on the worksheet. More detailed instructions can be found in Section IV: Waste Generation and Waste Stream.

Formulas:

Daily Average Volume	x	7 days	=	Weekly Average Volume
Daily Average Volume	x	30.5 days	=	Monthly Average Volume
Monthly Average Volume	x	12 months	=	Annual Average Volume

Average Volumes Of Sub-Areas In Tons

Sub-Area	Daily Average Volume	Weekly Average Volume	Monthly Average Volume	Annual Average Volume
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Waste Stream Of Sub-Areas (Per Day)

Worksheet 3

Year		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sub-Area	Population Growth																
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Worksheet 4

System Evaluation - Infrastructure Needs

Sub-Area _____

This worksheet will assist in evaluating the needs of each sub-area (a separate Worksheet 4 is provided for each of the possible ten sub-areas). Point values are assigned to answers for each question on the worksheet. Summing these values allows the user to quantitatively evaluate solid waste needs. More detailed instructions can be found in Section IV: Solid Waste Infrastructure.

To determine the needs of each area, several things must be considered for each type of infrastructure. Circle the appropriate answer for each evaluation question below. After answering all questions, total the scores associated with each answer and place them in the appropriate space.

Landfill / Incineration (or other "Final" Disposal) Considerations

Yes	No	
0	2	Is a final disposal location available within a reasonable distance from the last point of collection (100 miles in one direction)?
0	1	Does this final disposal location provide reasonable rates for disposal?
3	0	Does my governmental entity have the resources to support such a venture?
1	0	Does my governmental entity have the desire to maintain total control of disposal of municipal wastes generated by our citizens?
0	2	Are the citizens of this sub-area served by an entity that provides its own disposal services currently (a private company who prefers to use their own landfills)?
3	0	Is there a true need for this? NOTE: There is rarely a need for a governmental entity that does not already operate a "final" disposal location to begin operating one. Permitting and construction costs typically far exceed the costs related with other viable options like transfer stations.

Total Points _____

Citizens Collection Station Considerations

Yes	No	
3	0	Is there an illegal dumping problem in the sub-area?
0	2	Are the residents and businesses in this sub-area offered collection services, and therefore would not have a need for such a center?
0	1	Does the collection service offer heavy trash services, such that there would never be a need for a collection station?
0	2	Is there already a location where citizens can dispose their waste (such as a landfill or transfer station) within 10 miles?
3	0	Would citizens use the citizens collection station?

Total Points _____

Transfer Station Considerations

Yes	No	
2	0	Is my existing system paying too much for transportation and disposal of solid waste because the "final" disposal location is a long distance (greater than 25 miles in each direction)?
1	0	Have my existing collection needs exceeded the existing collection abilities?
1	0	Are there other entities in the sub-areas that currently use private services that would be interested in partnering to decrease transportation costs?
1	0	Is there a private company that would be interested in owning and operating a transfer station in my area?
0	3	Would the citizens of my area oppose a transfer station?
4	0	Are there customers (CCS locations) that will bring waste to the transfer station?

Total Points _____

Recycling Center Considerations

Yes	No	
1	0	Is there the desire for recycling services in my area?
0	1	Is there an existing private recycling program in my area?
1	0	Would recycling services be used by the citizens in this area?
5	0	Is there an available means of reuse for these recyclables and a company who would be willing to take them?
2	0	Are the resources available to support a recycling program?

Total Points _____

Residential Collection Services

Yes	No	
1	0	Is the population density such that individual disposal of waste is a problem?
0	2	Are residents willing to contract for disposal of their own waste, or is it being illegally disposed of?
0	2	Are private services available?
0	1	Are residents happy with the current services?
2	0	Is residential waste currently being illegally dumped?
2	0	Would residents be willing to pay a fee to fund residential collection services?

Total Points _____

Commercial Collection Services

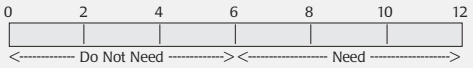
Yes	No	
1	0	Is the commercial density such that businesses are not able to adequately dispose of their own waste?
0	2	Are businesses willing to contract for disposal of their own waste?
1	0	Is commercial waste being illegally dumped?
0	2	Are private services available for commercial collection?
0	1	Are commercial collection customers happy with their existing service?

Total Points _____

Needs Of Each Sub-Area

Sub-Area	Landfill/ Incinerator	Citizens Collection Station	Transfer Station	Recycling Center	Residential Collection	Commercial Collection
Total Points from Questions						

Landfill/Incinerator



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Worksheet 5

Existing Solid Waste System - Infrastructure

This worksheet assists the user in delineating the existing solid waste system. An easy to read chart will demonstrate the solid waste infrastructure present in each sub-area. The worksheet also provides an initial idea of the current costs for existing solid waste services in the sub-area.

Outline the population sub-areas determined on Worksheet 1 on a map of the total service area. Using colored pencils, locate each category of the following solid waste infrastructure pieces in a different color. Some items will be drawn as point locations, while others will be shaded areas.

Item	Suggested Color
Landfill / Incinerator	Blue
Citizens Collection Station	Red
Transfer Station	Green
Recycling Center	Purple
Residential Collection	Yellow
Commercial Collection	Orange

Once the services have been identified, determine which sub-areas USE this service. Place an X in the box below each item that corresponds with a sub-area using that service.

Worksheet 5

Services Provided To Each Sub-Area

Sub-Area	Landfill/ Incinerator	Citizens Collection Station	Transfer Station	Recycling Center	Residential Collection	Commercial Collection
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Now determine the rates being paid by citizens for each of these services. Rates may vary by sub-area. Place the cost-per-capita of each service being provided in the chart above. Cost-per-capita is simply the total annual cost spent on a service (including capital and operations and maintenance) divided by the total number of people offered that service. If a service spans several sub-areas, determine the cost-per-capita over the entire coverage area.

Worksheet 6

Additional Services Needed

This worksheet provides a synopsis of what additional solid waste services are needed in each sub-area. Although something may be needed in several sub-areas, it may not need to be constructed in each. For example, one transfer station could serve an entire service area, and meet the needs of all sub-areas.

Compare Worksheets 4 (Needs) and 5 (Existing) to determine what is needed, but not existing in each sub-area. Place an X in the box below each item that corresponds with the sub-area needing that additional item.

Additional Services Needed In Each Sub-Area

Sub-Area	Landfill/ Incinerator	Citizens Collection Station	Transfer Station	Recycling Center	Residential Collection	Commercial Collection
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

System Evaluation - Costs

This worksheet sums the existing solid waste expenditures by category so that the cost-per-capita of each service can be calculated, as well as a total service area cost-per-capita. These categorized figures will be used when evaluating the impact of system enhancements on the total cost and total cost-per-capita.

The accuracy of the data collected for this worksheet will determine the accuracy of the final results. Begin by researching what is currently being spent on solid waste services in the total service area. A simple analysis would only include the amount being spent only on services provided by the local government. A very detailed analysis would include the amount being spent by the local government and the citizens. The extent of the analysis performed is at the discretion of the person performing the analysis.

Place the total annual cost of each service provided and the number of people this service is offered to on Lines 1 through 9 of Worksheet 7. Guidelines for each category are shown below. Once the cost and the population have been determined, the cost-per-capita can be calculated by simply dividing the cost by the population. Place the cost-per-capita for each service offered on the appropriate line.

Line 1: **Disposal Cost** - The amount spent on landfilling, incinerating, or otherwise disposing of waste. This should include the tipping fee, cost of transportation to the disposal facility, and any personnel or administrative costs associated with disposal activities.

Line 2: **Recycling Cost** - This number should include the cost of personnel associated with recycling activities, cost of recycling materials, operations and maintenance associated with recycling, collection of recyclable materials, etc.

Line 3: **Residential Collection Cost** - This number should include all costs involved with collection of residential waste by existing means. Include items such as personnel, administrative, billing, transportation, maintenance, fuel costs, etc.

Line 4: **Commercial Collection Cost** - This number should include all costs involved with collection of commercial waste by existing means. Include items such as personnel, administrative, billing, transportation, maintenance, fuel costs, etc.

Line 5: **Illegal Dumping** - This number should include costs involved in cleanups of illegal dump sites, additional personnel needed to patrol for illegal dumping, litigation costs involved in prosecuting illegal dumping offenders, administrative costs of processing paperwork, additional mosquito control required due to presence of sites, etc. An amount should also be specified to quantify the amount of lost tax revenue due to the blighted appearance of the areas with illegal dumping problems. A recent H-GAC study found that illegal dumping in rural areas costs $2 to $3 per capita per year. A source for determining this number is H-GAC's illegal dumping workbook, which can be requested from Cheryl Mergo at H-GAC.

Line 6: **Solid Waste Education** - Include all educational costs related to solid waste activities, such as illegal dumping, recycling, landfilling, composting, promotion of facilities and services, incineration, etc.

Line 7: **Administrative Costs** - Many municipal organizations require that an amount be paid into the general fund to cover all general governmental administrative expenses. Estimate that amount here.

Line 8: **General Operations Costs** - This should include operating costs not covered in any of the above items. Examples of items to include are supplies, fuel for vehicles, benefit expenses for employees, permitting fees, professional services required to operate, etc.

Line 9: **Maintenance Costs** - This should include costs to maintain equipment and facilities. Include items such as landscaping, lawn care, required service on equipment, etc.

Once the cost-per-capita of each of these items has been determined, sum the total existing costs shown in lines 1 through 9 and place that number on line 10. Determine the total population currently being served by the total solid waste system and place this number on line 11. Calculate the total service cost-per-capita by dividing the total cost (line 10) by the total population (line 11). Place the total service cost-per-capita on line 12.

The cost-per-capita shown in line 12 probably won't be equal to the total of individual cost-per-capita because individual cost-per-capita calculations only consider the population served by that individual service. However, the total system cost-per-capita assumes that all citizens have access to all services.

Existing Solid Waste Costs - Annually

Perform all calculations using annual data.

		Cost	Population	Cost-Per-Capita
Line 1	Disposal Cost			
Line 2	Recycling Cost			
Line 3	Residential Collection Cost			
Line 4	Commercial Collection Cost			
Line 5	Illegal Dumping			
Line 6	Solid Waste Education			
Line 7	Administrative			
Line 8	General Operations			
Line 9	Maintenance			
Line 10	**Total Existing Cost**			
Line 11	Population of Service Area			
Line 12	**Total System Cost-Per-Capita**			

Cost Of Adding A Citizens Collection Station

This worksheet will assist in determining the total cost of adding a CCS to the existing solid waste system. Figures will need to be estimated from the material provided in Section IV: Citizens Collection Station or from the guidelines provided below. This worksheet provides methods of estimating capital up-front expense, as well as expected operating expenses.

The first step is determining the types of services the CCS will provide and how it will operate. This step was performed earlier in Section IV. Estimate costs for site preparation and place them in the appropriate locations on Worksheet 8.

Land - This should include the cost of purchasing property. If a rental agreement is being sought, the rent is an operating expense rather than a capital expense. The amount of land necessary depends upon the services that will be offered at the facility. The average rural convenience center occupies less than 1 acre. A guideline is provided below for property requirements:

Service Offered	Average Acreage Required
MSW Type 1 Collection - 40+ cubic yards/day	1/2
MSW Type 1 Collection - 10-40 cubic yards/day	1/4
MSW Type 1 Collection - 10- cubic yards/day	0 (mobile) - 1/4
Household Recycling Collection	1/8
Tire Collection	1/8
Brush Collection	1/8
Road Base Materials Diversion	1/4
Used Oil and Oil Filters (and/or Antifreeze)	0
Pallet Collection	1/8
White Goods Diversion	1/8

Engineering Services - Your facility may require some general design services. Often the city or county engineer can provide these. If this option is not available, it may be necessary to contract a professional engineering firm to provide design services and ensure any applicable permitting or registration requirements are met. Permitting requirement evaluations should include any necessary stormwater or drainage permits, air emission permits, and city or county permits. Transportation permits may also be required for transportation of materials for disposal. TNRCC requirements are discussed in Section IV: CCS Regulations.

Administrative - There will be costs involved with setting up the facility related to hiring employees, purchasing equipment, monitoring installation of equipment, and construction, etc. If a billing system is to be used, it will require implementation. All of these things must be done prior to opening a facility, and therefore should be included in the initial capital cost.

Site Preparation - Estimates for the construction of a ramp and pad or retaining wall are provided in Section IV: Citizens Collection Station, as well as diagrams of typical systems. Section IV also provides estimates for an attendant's building, fencing, and paving. Landscaping and signage cost estimates are easily obtained from local businesses. Enhancement options require varying degrees of additional site preparation. Items such as tire and brush collection require a cleared area for ground storage, and possibly a constructed pad. Large collection sites may desire covered areas to prevent the formation of large amounts of leachate.

Promotion / Education - There must be a means of advertising the new service. This can be achieved through the media, mailings, paid advertisements, or flyers distributed through the school systems. All of these items have associated costs, which should be considered.

Equipment - Estimates for scales, roll-off boxes, compactors, and transportation vehicles are provided in Section IV: Citizens Collection Station. The average volume of waste that will be received at the facility was determined in Worksheet 2. The peak rate was also calculated. The CCS should be designed to handle the peak volume. Determine which sub-areas will be served by the facility and estimate the peak volume of waste accordingly. Worksheet 2 provided a conversion from tons to cubic yards so that the type and size of collection containers could be estimated.

Miscellaneous - The facility will need items such as a cash register or other means of collecting fees, brooms, shovels, supplies, and locks for gates. Prices for these items vary, depending upon the location of the site.

Recycling - Estimates for recycling equipment can be found in Section IV: Citizens Collection Station.

Now that the individual costs to initiate the CCS have been estimated, the total capital cost can be determined by summing these amounts. A depreciation schedule must be created for accounting purposes and so that the replacement cost of items can be accrued for future replacement. Useful lives of equipment and construction materials are given in Section IV: Citizens Collection Station. The depreciation schedule in Worksheet 8 will facilitate the annual depreciation calculations.

Operating expenses will vary depending upon the type of CCS being constructed. If the facility will not have an attendant, labor costs can be reduced. Distance to the disposal or transfer facility and storage capacity at the CCS are large factors in determining the number of employees necessary for the facility.

Labor - Place the estimated number of hours per employee type and the estimated rate for each in the spaces provided. Extend these numbers by multiplying to determine the total direct labor expense. Indirect labor costs can be determined as a percentage of direct labor costs. Typically this number ranges from 25-50% depending upon benefits offered. Add the direct and indirect labor costs to estimate total labor costs for operating the CCS.

Transportation - The transportation costs will be determined by the distance the CCS is from the proposed disposal or transfer facility. Transportation costs are determined on a per mile basis. Generally, fuel and maintenance of trucks cost approximately $1 per mile.

Maintenance - The facility will require general maintenance work on a regular basis. Landscaping, erosion control measures, road repairs, and general maintenance to the structures and collection equipment will be required. Often these services can be provided by the governmental entities existing maintenance department.

Utilities - The facility may incur periodic expenses for water, sewer, electricity, portable bathroom facilities, telephone, etc. If the facility will be operating during any hours when it may be dark outside (including hazy days), electricity must be available for lights. If the facility is being rented, rather than purchased, include the rental fees as a utility expense.

Disposal - The total disposal cost can be estimated by multiplying the estimated average waste volume by the tipping fee at the identified disposal or transfer location. If a disposal cost is not already known, one can easily be obtained by contacting disposal sites in the area.

Recycling - If the facility plans to accept materials for recycling, then the costs associated with this activity need to be considered. These materials must be hauled to a different location than the disposal site. (Some areas have been able to entice recycling companies to haul the recycles in exchange for the materials at no cost.) There are many options to explore when considering larger recycling activities. Some of these are:

> ***Yard Waste Separation and Collection*** - The facility can dispose of this material with a private composter, compost it on site and use the materials or distribute them to citizens. Another option is to use a wood chipper to chip the materials and then reuse or redistribute the materials to citizens. The easiest of these is to deal with a private composting facility. Composting is a long process that is labor intensive. Wood chipping requires expensive, maintenance intensive machinery and can be very labor intensive. However, both composting and wood chipping offer the benefits of the end product which can be used for landscaping projects - potentially offsetting costs in other governmental departments.
>
> ***White Goods*** - The facility can separate white goods (appliances) for recycling. These materials require specially trained individuals to ensure that all CFCs have been removed prior to recycling or disposal of the metals. There are companies that will remove the CFCs in exchange for the revenues generated from the metal recycling. There are only a few companies that provide this service, so they can be slow to respond to requests. Another option is training an employee to remove the CFCs and having this person ensure proper status before sending the materials to a metal recycler.
>
> ***Tires*** - Since whole tires can not be landfilled, they must be disposed of properly. H-GAC offers a program for tire collection and disposal. The cost for recycling a tire is approximately $1 per tire.

Used Oil, Oil Filters, and/or Antifreeze - These items need to be disposed of with a certified recycler, and CAN NOT be placed in a MSW landfill. Some require that oil filters be hot drained and punched. Prices to recycle these materials range from $25-85 per 55 gallon drum for filters and antifreeze and $0-0.05 per gallon for oil. Most convenience centers will collect these items from citizens, but not from businesses.

Road Base Materials - Some convenience centers choose to collect used concrete, asphalt, bricks, etc. for use in future municipal projects. These items can be collected and stored without much additional cost. Only additional space is required.

Pallets - Pallets can be collected and transferred to pallet recycling companies. Some areas have programs where pallets are recycled by other governmental programs as workforce projects.

Total the recycling operations costs and include these in the total operating cost if recycling will be offered at the CCS. Total the operating costs and place the sum in the appropriate location.

Determine the population to be served by the CCS. The facility should serve a ten-mile radius. Place the estimated population in the appropriate location on Worksheet 8.

Determine the total cost-per-capita, capital investment-per-capita, and operating cost-per-capita by dividing the respective total by the estimated population, as shown below.

Total Cost-per-Capita	=	Total Depreciation and Operating Cost / Population
Total Capital Investment-per-Capita	=	Total Capital Investment / Population
Total Operating Cost-per-Capita	=	Total Operating Cost / Population

The costs-per-capita provide a governmental entity with a means of comparing costs of items. Also calculate the cost-per-ton and cost-per-cubic yard to determine the maximum rate that will be charged in a pay-as-you-throw system.

Cost-per-Ton	=	Total Depreciation and Operating Cost / Estimate Volume in Tons
Cost-per-Cubic Yard	=	Total Depreciation and Operating Cost / Estimate Volume in Cubic Yards

Cost Of Adding A Citizens Collection Station

Capital Costs

	Price Per Unit		No. of Units		Total Cost
Site Preparation					
Land	_____	*	_____	=	_____
Engineering Services	_____	*	_____	=	_____
Administrative	_____	*	_____	=	_____
Ramp and Retaining Wall	_____	*	_____	=	_____
Attendant Building	_____	*	_____	=	_____
Fencing	_____	*	_____	=	_____
Landscaping	_____	*	_____	=	_____
Roadbase Materials					
Crushed Rock	_____	*	_____	=	_____
Asphalt	_____	*	_____	=	_____
Concrete	_____	*	_____	=	_____
Signs	_____	*	_____	=	_____
Promotion/Education	_____	*	_____	=	_____
			Total Site Preparation		_____
Equipment					
Collection Trailers	_____	*	_____	=	_____
Dumpsters or Green Boxes	_____	*	_____	=	_____
Open Top Roll-Off Boxes					
20 Cubic Yards	_____	*	_____	=	_____
30 Cubic Yards	_____	*	_____	=	_____
40 Cubic Yards	_____	*	_____	=	_____
Closed Top Roll-Off Boxes	_____	*	_____	=	_____
Stationary Compactor	_____	*	_____	=	_____
Pickup Trucks	_____	*	_____	=	_____
One Ton Collection Truck	_____	*	_____	=	_____
Roll-Off Truck	_____	*	_____	=	_____
Truck Scale	_____	*	_____	=	_____
Miscellaneous	_____	*	_____	=	_____
			Total Equipment Cost		_____

Capital Costs

	Price Per Unit		No. Of Units		Total Cost
Recycling					
Additional Land	_____	*	_____	=	_____
Additional Road Materials					
Crushed Rock	_____	*	_____	=	_____
Asphalt	_____	*	_____	=	_____
Concrete	_____	*	_____	=	_____
Chipper or Shredder	_____	*	_____	=	_____
Partitioned Containers					
26 Cubic Yard, 4 Door	_____	*	_____	=	_____
Trailer Mounted	_____	*	_____	=	_____
Baler	_____	*	_____	=	_____
Hand Scale	_____	*	_____	=	_____
Can Crusher	_____	*	_____	=	_____
Used Oil or Antifreeze Container	_____	*	_____	=	_____

Total Recycling Cost _____

Total Initial Capital Costs _____

Annual Depreciation Schedule

Item	Total Cost	Divided By	Useful Life	=	Annual Depreciation Amount
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____

Annual Depreciation Schedule (cont.)

Vehicle Depreciation

_____ Loose (C.Y.)	/ divided by	_____ Volume of Collection Bin	=	_____ Required Trips per Day for Disposal		
_____ Trips per Day	* multiplied by	_____ Round-Trip Miles per Trip	=	_____ Miles per Day		
_____ Compacted (C.Y.)	/ divided by	_____ Volume of Collection Bin	=	_____ Required Trips per Day for Disposal		
_____ Trips per Day	* multiplied by	_____ Round-Trip Miles per Trip	=	_____ Miles per Day		

Total Miles Per Day = Loose Plus Compacted _____

_____ Miles per Day	* multiplied by	365 365 Days per Year	=	_____ Miles per Year		
200,000 200,000 Miles/ Truck Life	/ divided by	_____ Miles/Year	=	_____ Life of Vehicle		
		_____ Cost of Vehicle	/ divided by	_____ Life of Vehicle	=	_____ Annual Depreciation Amount

Total Annual Depreciation _____

8g

Operating Costs

Labor

Direct		Annual Hours	x	Hourly Wage	=	
Direct		Annual Hours	x	Hourly Wage	=	
Direct		Annual Hours	x	Hourly Wage	=	
Direct		Annual Hours	x	Hourly Wage	=	
Direct		Annual Hours	x	Hourly Wage	=	
Direct		Annual Hours	x	Hourly Wage	=	
Indirect Labor Costs	**=**	**Total Direct Cost**	**x**	**Percent Increase**	**=**	

Transportation & Maintenance		Total Miles	x	$1 / $1 per Mile	=	
Utilities		Average Monthly Expense	x	12 / 12 Months	=	
Disposal		Annual Waste Volume	x	Tipping Fee per Volume	=	
Recycling						

Total Operating Cost _____

Total Annual Depreciation and Operating Cost _____

8h

Operating Costs

Population Of Service Area _____

Total Cost-Per-Capita: _____ / _____ = _____
Total Annual Depreciation and Operating Costs — divided by — Population

Total Capital Investment-Per-Capita: _____ / _____ = _____
Total Capital Investment — divided by — Population

Total Operating Expense-Per-Capita: _____ / _____ = _____
Total Operating Expense — divided by — Population

Cost-Per-Ton: _____ / _____ = _____
Total Annual Depreciation and Operating Costs — divided by — Annual Volume in Tons

Worksheet 9

Cost Averted With The Addition Of A Citizens Collection Station

This worksheet determines the amount of currently expended funds that would no longer be necessary with the addition of a CCS. Review Worksheet 7 and determine what existing expenditures would be diverted. An example would be the diversion of expenditures on illegal dumping because citizens would now have a convenient and affordable means of disposing of their waste legally.

Total Cost That Could Be Diverted By CCS

Landfill	_____
Incinerator	_____
Citizens Collection Station	_____
Transfer Station	_____
Recycling Collection	_____
Residential Collection Services	_____
Commercial Collection Services	_____
Illegal Dumping	_____
Total	_____
Total Population Serviced By New CCS	_____
Cost-Per-Capita In Savings	_____

Cost Of Adding A Transfer Station

This worksheet will assist in determining the total cost of adding a transfer station to the existing solid waste system. Figures will need to be estimated from the material provided in Section IV: Transfer Station or from the guidelines provided below. This worksheet provides methods of estimating capital up-front expense, as well as expected operating expenses.

The first step is determining the types of services the transfer station will provide and how it will operate. This step was performed earlier in Section IV. Estimate costs for site preparation and place them in the appropriate locations on Worksheet 10.

Land - This should include the cost of purchasing property. If a rental agreement is being sought, the rent is an operating expense rather than a capital expense. The amount of land necessary depends upon the services that will be offered at the facility. The average rural transfer station occupies 2-5 acres.

Engineering Services - Your facility will require engineering design services. Often the city or county engineer can provide these. If this option is not available, it may be necessary to contract a professional engineering firm to provide design services and ensure any applicable permitting or registration requirements are met. Permitting requirement evaluations should include any necessary stormwater or drainage permits, air emission permits, and city or county permits. Transportation permits may also be required for transportation of materials for disposal. TNRCC requirements are discussed in Section IV: Transfer Station Regulations.

Administrative - There will be costs involved with setting up the facility related to hiring employees, purchasing equipment, monitoring installation of equipment and construction, etc. If a billing system is to be used, it will require implementation. All of these things must be done prior to opening a facility, and therefore should be included in the initial capital cost.

Site Preparation - Estimates for the construction of items needed in a transfer station are provided in Section IV: Transfer Station. Landscaping and signage cost estimates are easily obtained from local businesses. Enhancement options require varying degrees of additional site preparation. Items such as tire and brush collection require a cleared area for ground storage, and possibly a constructed pad. Large collection sites may desire covered areas to prevent the formation of large amounts of leachate.

Promotion / Education - There must be a means of advertising the new service. This can be achieved through the media, mailings, paid advertisements, or flyers distributed through the school systems. All of these items have associated costs, which should be considered.

Equipment - Estimates for scales, roll-off boxes, compactors, and transportation vehicles are provided in Section IV: Transfer Station. The average volume of waste that will be received at the facility was determined in Worksheet 2. The peak rate was also calculated. The transfer station should be designed to handle the peak volume. Determine which sub-areas will be served by the facility, and estimate the peak volume of waste accordingly. Worksheet 2 provided a conversion from tons to cubic yards so that the type and size of collection containers could be estimated.

Miscellaneous - The facility will need items such as a cash register, or other means of collecting fees, brooms, shovels, supplies, and locks for gates. Prices for these items vary, depending upon the location of the site.

Recycling - Estimates for recycling equipment can be found in Section IV.

Now that the individual costs to initiate the transfer station have been estimated, the total capital cost can be determined by summing these amounts. A depreciation schedule must be created for accounting purposes and so that the replacement cost of items can be accrued for future replacement. Useful lives of equipment and construction materials are given in Section IV. The depreciation schedule in Worksheet 10 will facilitate the annual depreciation calculations.

Operating expenses will vary depending upon the type of transfer station being constructed. Distance to the disposal or transfer facility and storage capacity at the transfer station are large factors in determining the number of employees necessary for the facility.

Labor - Determine the estimated number of hours per employee type and the estimated rate for each in the spaces provided. Extend these numbers by multiplying to determine the total direct labor expense. Indirect labor costs can be determined as a percentage of direct labor costs. Typically this number ranges from 25-50% depending upon benefits offered. Add the direct and indirect labor costs to estimate total labor costs for operating the transfer station.

Transportation - The transportation costs will be determined by the distance the transfer station is from the proposed disposal or transfer facility. Transportation costs are determined on a per mile basis. Generally fuel and maintenance of trucks cost approximately $1 per mile.

Maintenance - The facility will require general maintenance work on a regular basis. Landscaping, erosion control measures, road repairs, and general maintenance to the structures and collection equipment will be required. Often these services can be provided by the governmental entities' existing maintenance department.

Utilities - The facility may incur periodic expenses for water, sewer, electricity, telephone, etc. If the property is being rented, rather than purchased, include the rental amount as a utility.

Disposal - The total disposal cost can be estimated by multiplying the estimated average waste volume by the tipping fee at the identified disposal or transfer location. If a disposal cost is not already known, one can easily be obtained by contacting disposal sites in the area.

Recycling - If the facility plans to accept materials for recycling, then the costs associated with this activity need to be considered. These materials must be hauled to a different location than the disposal site. (Some areas have been able to entice recycling companies to haul the recycles in exchange for the materials at no cost.) There are many options to explore when considering larger recycling activities. Some of these are:

Yard Waste Separation and Collection - The facility can dispose of this material with a private composter, compost it on site and use the materials or distribute them to citizens. Another option is to use a wood chipper to chip the materials and then reuse or redistribute the materials to citizens. The easiest of these is to deal with a private composting facility. Composting is a long, labor intensive process. Wood chipping requires expensive, maintenance intensive machinery and can be very labor intensive. However, both composting and wood chipping offer the benefits of the end product which can be used for landscaping projects - potentially offsetting costs in other governmental departments.

White Goods - The facility can separate white goods (appliances) for recycling. These materials require specially trained individuals to ensure that all CFCs have been removed prior to recycling or disposal of the metals. There are companies that will remove the CFCs in exchange for the revenues generated from the metal recycling. There are only a few companies that provide this service, so they can be slow to respond to requests. Another option is training an employee to remove the CFCs and having this person ensure proper status before sending the materials to a metal recycler.

Tires - Since whole tires can not be landfilled, they must be disposed of properly. H-GAC offers a program for tire collection and disposal. The cost for recycling a tire is approximately $1 per tire.

Used Oil, Oil Filters, and/or Antifreeze - These items need to be disposed of with a certified recycler, and CAN NOT be placed in a MSW landfill. Some require that oil filters be hot drained and punched. Prices to recycle these materials range from $25-85 per 55 gallon drum for filters and antifreeze and $0-0.05 per gallon for oil. Most transfer stations will collect these items from citizens, but not from businesses.

Road Base Materials - Some transfer stations choose to collect used concrete, asphalt, bricks, etc. for use in future municipal projects. These items can be collected and stored without much additional cost. Only additional space is required.

Pallets - Pallets can be collected and transferred to pallet recycling companies. Some areas have programs where pallets are recycled by other governmental programs as workforce projects.

Total the recycling operations costs and include these in the total operating cost if recycling will be offered at the transfer station. Total the operating costs and place the sum in the appropriate location.

Determine the population to be served by the transfer station. The facility should serve a large radius. Place the estimated population in the appropriate location on Worksheet 10.

Determine the total cost-per-capita, capital investment-per-capita, and operating cost-per-capita by dividing the respective total by the estimated population, as shown below.

Total Cost-per-Capita	=	Total Depreciation and Operating Cost / Population
Total Capital Investment-per-Capita	=	Total Capital Investment / Population
Total Operating Cost-per-Capita	=	Total Operating Cost / Population

The costs-per-capita provide a governmental entity with a means of comparing costs of items. Also calculate the cost-per-ton and cost-per-cubic yard to determine the maximum rate that will be charged in a pay-as-you-throw system.

Cost-per-Ton	=	Total Depreciation and Operating Cost / Estimate Volume in Tons
Cost-per-Cubic Yard	=	Total Depreciation and Operating Cost / Estimate Volume in Cubic Yards

Cost Of Adding A Transfer Station

Capital Costs

	Price Per Unit		No. Of Units		Total Cost
Site Preparation					
Land					
Engineering Services					
Administrative					
Transfer Station Building					
Concrete Work and Foundations					
Retaining Wall					
Attendant Building					
Fencing					
Site Work					
Landscaping					
Roadbase Materials					
Crushed Rock					
Asphalt					
Concrete					
Signs					
Promotion/Education					
			Sub-Total of Site Preparation		
Contingency (10% of Sub-Total)					
			Total Site Preparation		
Equipment					
Open Top Roll-Off Boxes					
20 Cubic Yards		*		=	
30 Cubic Yards		*		=	
40 Cubic Yards		*		=	
Closed Top Roll-Off Boxes		*		=	
Stationary Compactor		*		=	
Pickup Trucks		*		=	
Transfer Truck		*		=	
Trailer for Transfer Truck		*		=	
Roll-Off Truck		*		=	
Knuckle Boom		*		=	
Front End Loader		*		=	
Truck Scale		*		=	
Miscellaneous		*		=	
			Total Equipment Cost		

10e

Capital Costs

	Price Per Unit		No. Of Units		Total Cost
Recycling					
Additional Land	_____	*	_____	=	_____
Additional Road Materials					
Crushed Rock	_____	*	_____	=	_____
Asphalt	_____	*	_____	=	_____
Concrete	_____	*	_____	=	_____
Chipper or Shredder	_____	*	_____	=	_____
Partitioned Containers					
26 Cubic Yard, 4 Door	_____	*	_____	=	_____
Trailer Mounted	_____	*	_____	=	_____
Baler	_____	*	_____	=	_____
Hand Scale	_____	*	_____	=	_____
Can Crusher	_____	*	_____	=	_____
Used Oil or Antifreeze Container	_____	*	_____	=	_____

Total Recycling Cost _____

Total Initial Capital Costs _____

Annual Depreciation Schedule

Item	Total Cost	Divided By	Useful Life	=	Annual Depreciation Amount
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____
_____	_____	/	_____	=	_____

Annual Depreciation Schedule

Vehicle Depreciation

_____ Volume (C.Y.)	/ divided by	_____ Volume of Collection Bin	=	_____ Required Trips per Day for Disposal		
_____ Trips per Day	* multiplied by	_____ Round-Trip Miles per Trip	=	_____ Miles per Day		
_____ Miles per Day	/ multiplied by	365 _____ 365 Days per Year	=	_____ Miles per Year		
200,000 _____ 200,000 Miles/ Truck Life	/ divided by	_____ Miles/Year	=	_____ Life of Vehicle		
		_____ Cost of Vehicle	/ divided by	_____ Life of Vehicle	=	_____ Annual Depreciation Amount

Total Annual Depreciation _____

Operating Costs

Labor

Direct	Annual Hours	x	Hourly Wage	=	
Direct	Annual Hours	x	Hourly Wage	=	
Direct	Annual Hours	x	Hourly Wage	=	
Direct	Annual Hours	x	Hourly Wage	=	
Direct	Annual Hours	x	Hourly Wage	=	
indirect Labor Costs =	**Total Direct Cost**	**x**	**Percent Increase**	**=**	

Transportation And Maintenance	Total Miles	x	$1 / $1 per Mile	=	
Utilities	Average Monthly Expense	x	12 / 12 Months	=	
Disposal	Annual Waste Volume	x	Tipping Fee per Volume	=	
Recycling					

Total Operating Cost _____

Total Annual Depreciation and Operating Cost _____

10h

Operating Costs

Population Of Service Area _____

Total Cost-Per-Capita: _____ (Total Annual Depreciation and Operating Cost) / _____ (divided by Population) = _____

Total Capital Investment-Per-Capita: _____ (Total Capital Investment) / _____ (divided by Population) = _____

Total Operating Expense-Per-Capita: _____ (Total Operating Expense) / _____ (divided by Population) = _____

Cost-Per-Ton: _____ (Total Annual Depreciation and Operating Costs) / _____ (divided by Annual Volume in Tons) = _____

Worksheet 11

Cost Averted With The Addition Of A Transfer Station

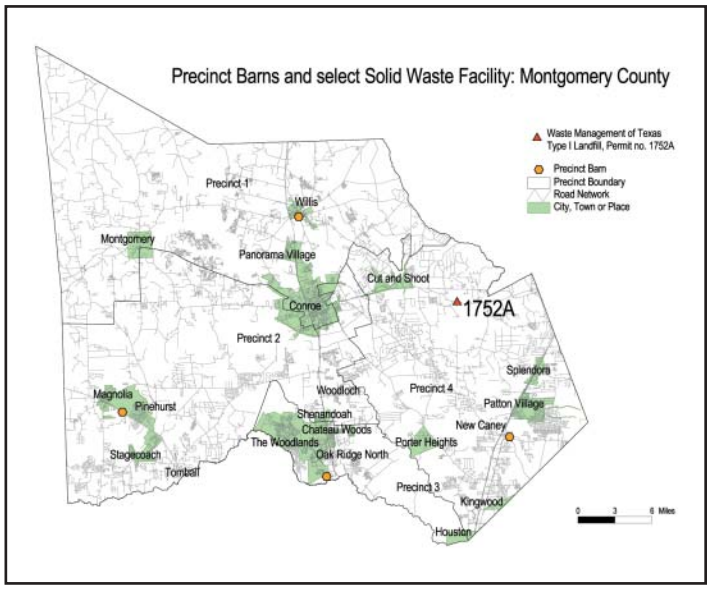
This worksheet determines the amount of currently expended funds that would no longer be necessary with the addition of a transfer station. Review Worksheet 7 and determine what existing expenditures would be diverted. An example would be the diversion of expenditures on illegal dumping because citizens would now have a convenient and affordable means of disposing of their waste legally.

Total Cost That Could Be Diverted By Transfer Station

Landfill	_____
Incinerator	_____
Citizens Collection Station	_____
Transfer Station	_____
Recycling Collection	_____
Residential Collection Services	_____
Commercial Collection Services	_____
Illegal Dumping	_____
Total	_____
Total Population Serviced By New Transfer Station	_____
Cost-Per-Capita In Savings	_____

VI. MONTGOMERY COUNTY EVALUATION

Montgomery County was chosen for this evaluation because of its severe illegal dumping problems. The Texas Natural Resource Conservation Commission has had more enforcement cases filed against this county than any other in the 13 county H-GAC region. The largest illegal dumping problems have resulted from the rapid growth of the area and the construction debris being illegally disposed of. In addition to construction related waste, residential waste is also a problem in the rural areas. Many rural residents are not willing to pay the subscriptions only rate for solid waste services and they do not have a convenient location to legally dispose of their waste.



The evaluation of Montgomery County provides an example of how to evaluate your own city or county for additional solid waste infrastructure needs. An overview of the county's demographics, existing solid waste infrastructure, administration, and existing costs are provided in this section. Following that is a description of the process used to complete worksheets 1-11, completed worksheets for Montgomery County, and recommendations for Montgomery County.

Demographics

Montgomery County is located immediately north of Houston and has quickly changed from a predominately rural county to one of the fastest growing suburban areas in the H-GAC region. It is projected that by the year 2010, Montgomery County's population will reach 325,500. Recently the population has grown from 128,487 in 1980 to an estimated 245,404 in 1999, representing an annual growth of 3.9%. A population breakdown by area of the county is provided in Table 33.

A large portion of this growth is occurring in The Woodlands, a master planned community, which has grown from a population of 8,443 in 1980 to 47,346 in 1996. This area alone has a population growth rate of 11.4%. The Woodlands is a major middle and upper income mixed-use development located in south Montgomery County. It is an unincorporated community which uses both corporate and residential organizational capabilities to institute waste management policies and programs.

The City of Conroe is the largest incorporated city in the county, having a population of 39,387. Conroe serves as the County Seat. Approximately 133,037 residents, or 56.3% of the people within Montgomery County, live in rural areas. Another rapidly growing community is Porter located in the southeastern portion of the county. Lake Conroe, located in the northwestern portion of the county, is a major recreational area. Large quantities of the northern section of the county are located in the Sam Houston National Forest. In general, the majority of the county is agricultural or wooded with several scattered small towns.

Table 33: Montgomery County Population Data

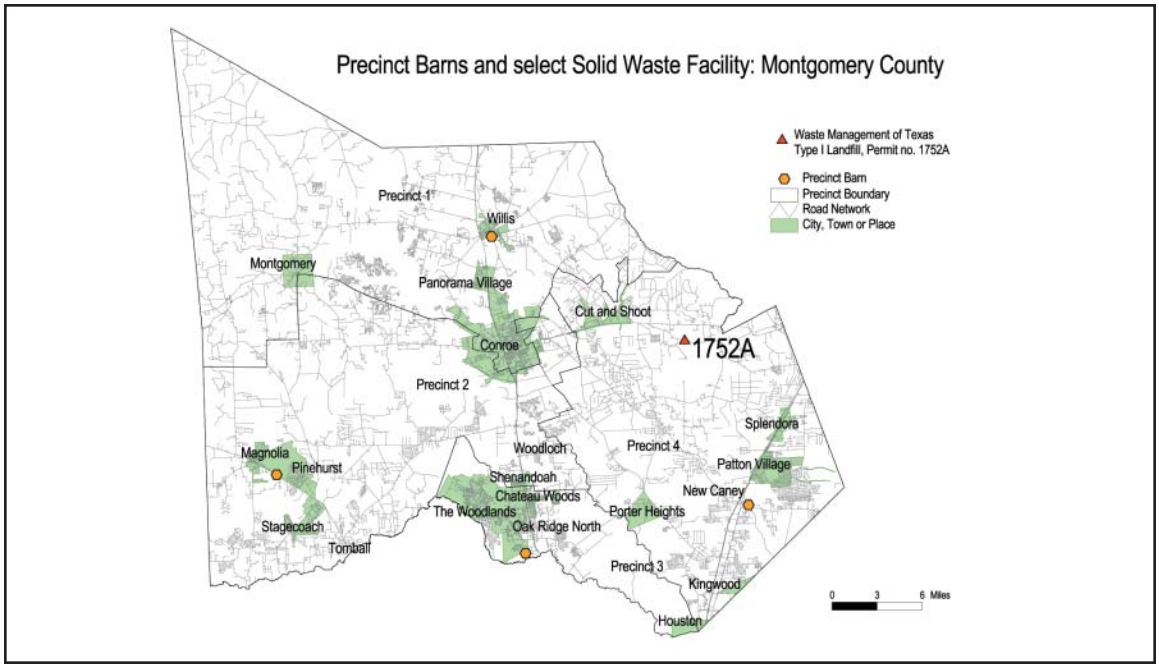
(Source: "H-GAC Illegal Dumping Study in Montgomery and Wharton Counties," December 1997)

Year	The Woodlands	Conroe	Rural Residents	Other Cities	Total Montgomery County
1980	8,443	18,034	86,933	15,077	128,487
1990	29,205	27,610	104,397	20,989	182,201
1995	36,627	37,761	130,135	25,730	230,253
1996	47,346	39,387	133,037	16,422	236,192
1999	49,192	40,923	138,225	17,064	245,404
Growth Rate (1980 to 1996)	**11.4%**	**5%**	**2.7%**	**0.5%**	**3.9%**

In addition to the significant residential, commercial, and light industrial development in the southern portion of Montgomery County, growth is also occurring in the northern portion of the county along the I-45 corridor and Lake Conroe. Montgomery County is approximately 1,090 square miles in size.

Montgomery County is divided into four precincts, which currently operate their own individual solid waste infrastructure programs. Precinct 1 covers the northern part of the county and is primarily rural with its population density concentrated around Lake Conroe. Precinct 2 consists of the western part of the county, including rural areas as well as urban populations in The Woodlands. This precinct houses the Tamina area where the largest and most active illegal landfills in the county have historically operated. Precinct 3 is located in the southern part of the county and is the most urban precinct. It includes the most currently developed parts of The Woodlands, other unincorporated subdivisions, and the City of Oak Ridge North. Although there are not notable illegal dumping problems in Precinct 3, authorities have determined that large quantities of illegally dumped material in Precinct 2 originate in Precinct 3. Precinct 4 is formed by the eastern portion of the county and is primarily rural in nature. A map of the precincts is shown as Figure 28.

Figure 28: Montgomery County and its Precincts



The county's economy is based on mineral production, agriculture, and timber. The major corporate taxpayers in the county for 1998 are listed below.

Taxpayer	Type of Business
Woodlands Land Development Corporation & Woodlands Commercial Development Corp.	Land Development
Exxon Corporation	Oil Properties
Gulf States Utilities Company	Electric Utility
Huntsman Petrochemical Corporation	Oil Properties
Columbia Regional Medical Center	Medical
Eckerd Distribution	Retail Drug Distribution
Lufkin-Conroe Telephone	Telephone Utility
Mitchell Energy Corporation	Oil Properties
Southwestern Bell Telephone	Telephone Utility
Wal-Mart Inc. / Sam's Club	Retail Store

In 1994, a Montgomery County Solid Waste Management Screening Study was performed. This study estimated that over 60% of the waste stream in this area is contributed by commercial businesses. Considering this contribution of waste led the study to determine that the per capita waste generation in Montgomery County is 7.32 pounds per person per day.

Since most of the employment generators are agricultural, institutional, or recreational, the waste stream is expected to include high levels of paper waste and low levels of industrial and hazardous waste when compared to more industrial regions.

There are a large number of private companies who compost yard waste materials in Montgomery County. In addition, the Woodlands has an active "Don't Bag It" program and a compost demonstration area. H-GAC Grant Due to this aggressive diversion of yard waste materials, the waste stream in the county only consists of 2.5% yard waste, as opposed to the typical rate of 15.9%.

Existing Infrastructure

Prior to 1996, three permitted landfills legally operated in Montgomery County. These included the Western Waste Industries (currently Waste Management)/City of Conroe Landfill, the Security Landfill (Waste Management), and the Montgomery County landfill. The Western Waste/City of Conroe landfill reached its permitted capacity in 1997 and closed. The Montgomery County landfill was closed by Western Waste and was replaced with a Class I non-hazardous industrial waste landfill. Currently, there is only one operating Type I, Subtitle D landfill facility: Waste Management's Security Landfill. It serves both Montgomery County and surrounding counties. This facility accepted approximately 200,000 tons of solid waste in 1998. Montgomery County does not have any Type IV landfills or any Type V transfer facilities.

Montgomery County does not provide solid waste collection services for its residents, whether living in the incorporated municipalities located within its geographic boundary or within its rural areas. According to current regulations, Montgomery County is responsible for ensuring that services are available for unincorporated areas because its population is greater than 30,000. Many of the residents handle their own waste disposal by: (1) transporting waste to local landfills; (2) contracting haulers individually; (3) burying waste on their property; or (4) burning household waste on-site.

The Montgomery County environmental enforcement officers estimate that 2/3 of the illegal dumping sites they discover consist of municipal household waste and 1/3 of the sites they encounter are construction and demolition (C&D) debris. However, the volume of C&D material is 70% of the total volume of illegally disposed waste.

The high incidence of illegal dumping is caused by the large amount of new development occurring in Montgomery County and the lack of convenient disposal options. Homebuilders seeking to dispose of construction debris do not have convenient access to cost-effective legal disposal sites. The county is home to one active Subtitle D landfill, located on Highway 105 halfway between Conroe and Cleveland. This is approximately 1.5 hours roundtrip from the rapid residential construction in The Woodlands, which is typical of southern Montgomery County. By comparison, illegal dumpsites in the Tamina area just east of I-45 are centrally located in southern Montgomery County and approximately ten minutes from residential construction in The Woodlands.

Environmental officer works overtime to enforce laws

By BARBARA NEWMAN
Managing Editor

During his first month on the job, the Montgomery County Precinct 4 Environmental Enforcement Officer worked 25 cases. After just three months, his case load has soared to 85.

Officer C. E. Eldridge began his tour of duty Dec. 9 in the recently created position funded by a $66,000 environmental grant from the Houston-Galveston Area Council.

His salary for the first year, his vehicle and other equipment are covered by the grant, and due to the success of the program, Jim Deaton, administrative aide to Commissioner Jim Simmons says they are going back in July for additional grant money to supply more environmental officers.

"We haven't even scratched the surface yet," Eldridge says. "There are so many little nooks and crannies that make illegal dumping easy to hide that it really keeps me running.

Eldridge works with other agencies in Montgomery County and surrounding areas, but his main focus is to clean up the areas in Precinct 4.

"The people have really been receptive, and most have been helpful in getting things cleaned up," he says. "But it's real simple, either obey the law, pay a fine or go to jail."

Eldridge and Deaton say they are amazed at some of the dump sites they have located.

See **Environmental**, page 8A

Montgomery County currently has two environmental enforcement officers specifically assigned to precinct areas. The county recently submitted a grant proposal to H-GAC to fund a third environmental enforcement officer. This position would operate from the County Environmental Health Department. The county hopes to begin coordinating all solid waste issues from one point of contact, rather than through each precinct, so that resources can be shared and the county can become more focussed on the needs of the entire county.

The Woodlands

The Woodlands Recycling Drop-Off Center

The Woodlands master-planned community provides its private citizens residential collection and curbside recycling collection through private waste collection contracts administered by The Woodlands Community Association (WCA) and The Woodlands Association (TWA). Corporate citizens of The Woodlands are provided commercial collection through private waste collection contracts administered by The Woodlands Commercial Property Owners Association (WCOA). The area also houses a recycling collection center H-GAC Grant operated under a private contract administered by the Woodlands Community Service Corporation (WCSC). All of the private contracts currently in place for collection and recycling are held by Waste Management.

City of Conroe

The City of Conroe collects residential solid waste two times per week and heavy trash one time per month. The monthly cost of the City of Conroe Solid Waste Program is $10.28 per household per month. Yard waste is also collected and transported to a composting facility. The city offers a curbside recycling program, which is privately operated. In 1994, 271 tons of recyclable materials were collected, 70% of which was paper. The cost per household of the curbside recycling program is a one-time fee of $16. Since this is a voluntary program only 25% of residents participate. BFI also operates a recycle collection station in Conroe, which is free to all Montgomery County residents.

Precinct 1

Precinct 1 does not currently offer any solid waste services to its citizens.

Precinct 2

Precinct 2 employs one of the two Montgomery County Environmental Enforcement officers. This armed officer patrols the county, specifically the Precinct 2 area, identifying illegal dump sites, determining who the offender is, and orchestrating the clean-up of the site.

Precinct 3

Entrance to Precinct 3 County Barn

Precinct 3 provides a 30 cubic yard roll-off box at the precinct barn for residents to dispose of their white goods, do-it-yourself construction debris, tree limbs, and brush. No municipal solid waste is accepted at this location. This service is offered free of charge and is available 24 hours a day, 7 days a week. The facility is monitored during regular business hours of the precinct barn, but open and unmanned after-hours. An eight cubic yard container is also available near the adjacent ballpark. Contamination of the collection boxes is estimated at less than 5%. The largest portion of the contamination is tires and batteries.

Precinct 3 County Barn

White goods are recycled by Precinct 3 maintenance staff, who remove the CFCs and recycle the metals. Precinct 3 spends approximately $1500 per month on disposal of waste collected at the precinct barn. An additional $800 per month is spent cleaning up illegal dumpsites. When an illegal site is found, a letter is sent giving the perpetrator 24 hours to clean up the site. If this does not happen, the precinct cleans the site and takes legal action against the perpetrator. Precinct personnel estimate that 90% of the time the county cleans up the illegal dump sites.

Precinct 4 Recycle Center

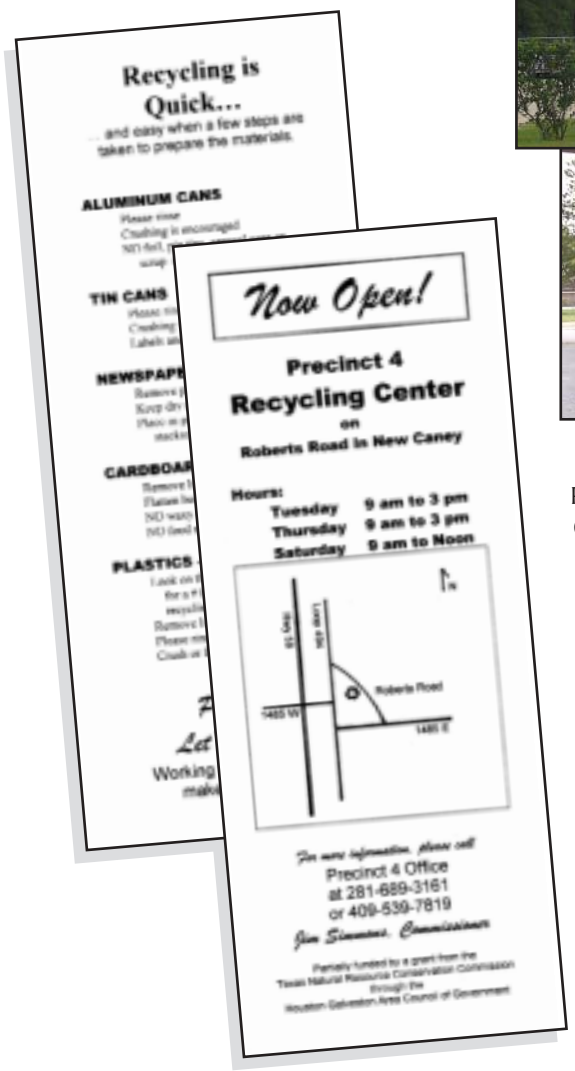
Precinct 3 does not have a specific person dedicated to solid waste issues. Collection services are offered to the majority of Precinct 3 residents through their homeowners association. According to a recent H-GAC Illegal Dumping study, the Precinct 3 commissioner estimates that illegal dumping has decreased up to 75% in the precinct since these drop-off boxes were made available in 1995.

Precinct 4

Precinct 4 operates a recycling drop-off center, which began collecting recyclable materials at the county barn on April 5, 1997. The facility accepts plastics, cans, glass, paper, cardboard, used motor oil, and old batteries free of charge. The precinct has contracted with BFI to furnish the collection bins and haul the recyclables to a recycling center. In exchange for providing these services, BFI keeps any revenue generated from the sale of the recyclable materials. The goal of Precinct 4 is to break-even in its recycling efforts. Precinct 4 also collects white goods at the recycling facility.

Precinct 4 County Barn

Precinct 4 Recycling Drop- Off Center



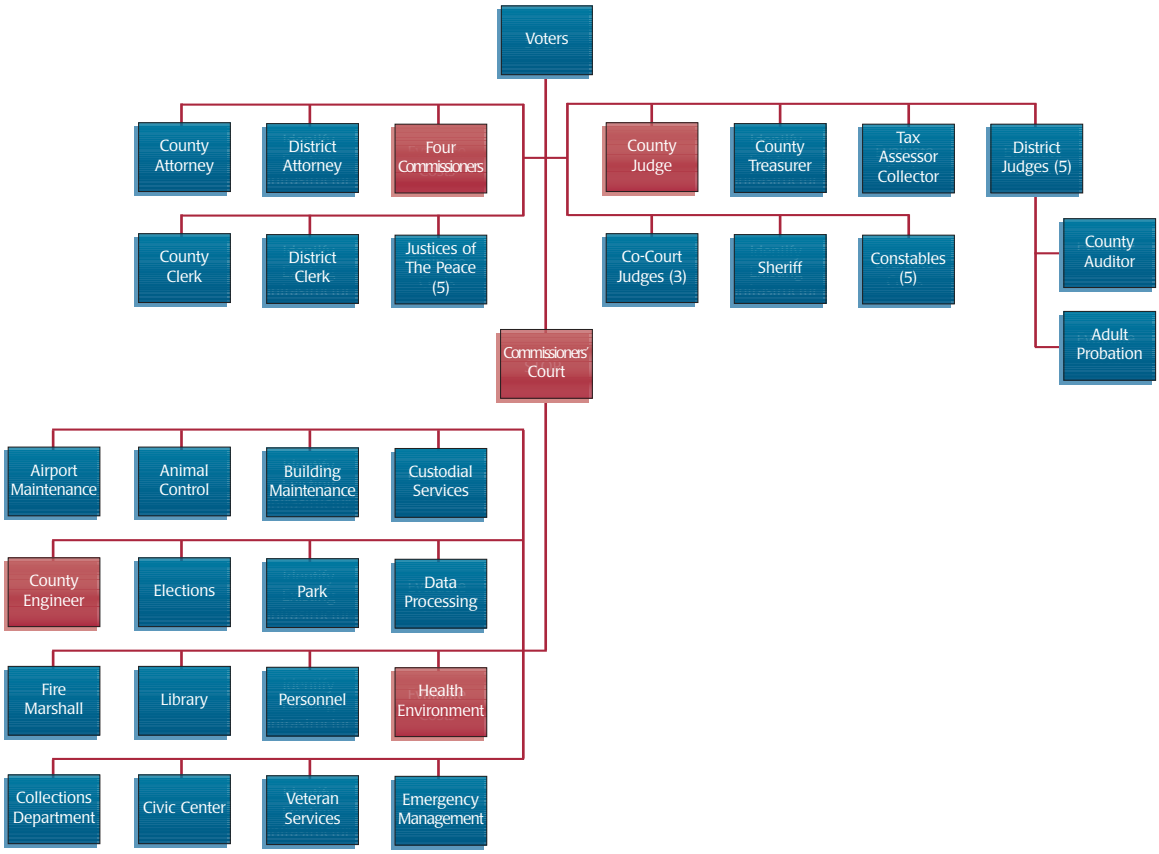
Precinct 4 employs one of the two Montgomery County Environmental Enforcement officers. This armed officer patrols the county, specifically the Precinct 4 area, identifying illegal dump sites, determining who the offender is, and orchestrating the clean-up of the site. The Precinct 4 officers estimated that 90% of the time offenders will clean up the site to avoid the fine. The other 10% of the time, sites are cleaned by county road crews. Tires are the largest item found in illegal dumpsites in this portion of the county.

Newspaper articles quote the past Precinct 4 Commissioner saying, "Eventually the center also may take some household garbage. We're looking into a program that would work like this: If you come up to Precinct 4 barn with your recyclables already separated and in order, then we're going to try to be able to accept some household garbage for a small fee."

Administration

Several different entities, rather than a single point of contact, currently handle solid waste issues. Each precinct chooses to either allocate funds to solid waste or not. The county government addresses solid waste issues in the Health and Environment Department. The majority of the issues addressed are illegal dumping. Figure 29 is the organization chart for Montgomery County, showing the relationship of each of these various entities.

Figure 29: Montgomery County Organization Chart

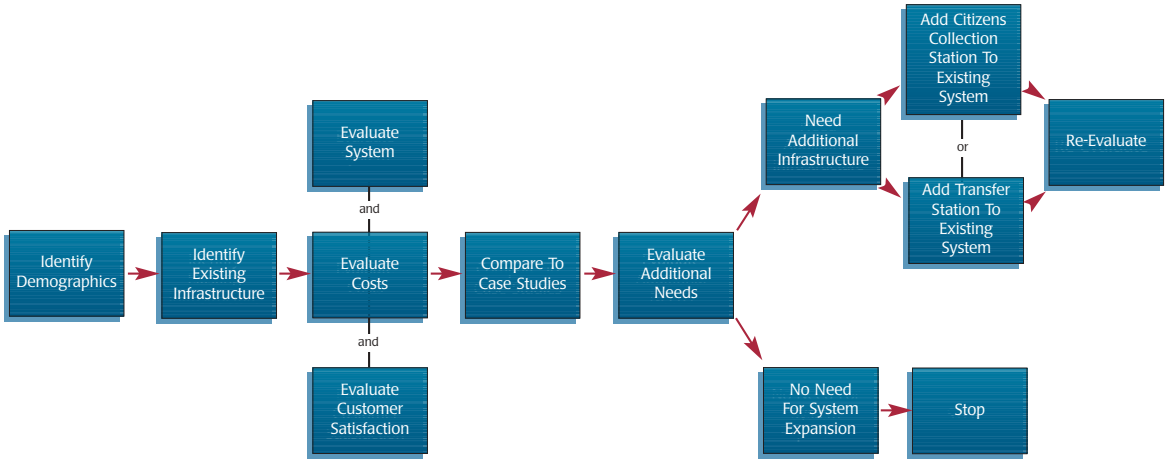


Existing Costs

Montgomery County currently spends an estimated $390,775 per year dealing with illegal dumping related activities (clean-up, collection, disposal, enforcement, and prosecution). The City of Oak Ridge North and Montgomery County Drainage District Number 6 spend an additional $101,626 on illegal dumping activities. Collectively, they spend $492,401 per year dealing with illegal dumping activities or $2.08 per capita, per year.

Process to Complete Evaluation Worksheets

Flow Chart of Evaluation Process



STEP 1: Determine Total Service Area

The total service area to be used in the Montgomery County evaluation shall be Montgomery County plus the surrounding unserviced areas. The evaluation will be performed assuming that Montgomery County will charge a fee for the use of its solid waste facilities and will allow anyone to use them.

STEP 2: Divide the Total Area Into Sub-Areas

Using Worksheet 1, Montgomery County was divided into sub-areas. The worksheet was completed as follows:

1. Using the Montgomery County Total Population Census Block map (Exhibit 1), we identified the higher density areas, and circled them in red. Since there were more than ten red circles, we enlarged the circles until there were only ten dense areas.

2. Using the ten red circles as guidelines, we divided the county into ten sub-areas. The analysis was simplified by locating the sub-area boundaries along census block borders. We drew the sub-areas on Exhibit 1 and transferred them to Exhibit 2 to verify accuracy along census block lines. Since ten sub-areas were identified, we placed that number in Line 2 of Worksheet 1.

3. Now that the ten sub-areas are identified and outlined on the Census Tract map, we obtained census population data for each census block from H-GAC. This information can also be found on the website http://venus.census.gov. This data is shown as Exhibit 3. Since the available data is from 1990, we made the assumption that the county has grown uniformly over the past eight years. We transferred the data to the census block map as shown in Exhibit 4. The total population was placed on Line 1 of Worksheet 1.

4. We summed the population totals of the census blocks in each sub-area and recorded them in the spaces provided on Line 3 of Worksheet 1.

5. The percentage of total population in each of the sub-areas was calculated by dividing the sub-area population by the total population and multiplying by 100. These numbers were placed in the spaces provided on Line 4 of Worksheet 1.

6. Using the percentages from Line 4 of Worksheet 1, we ranked the sub-areas from highest to lowest population in Line 5 of Worksheet 1. We have now determined which sub-areas have the largest populations. This will allow us to determine which areas need services more than others, if necessary.

STEP 3: Determine Waste Generation Volumes

Using Worksheet 2, Montgomery County waste generation volumes were calculated as follows:

1. Using the population data for each sub-area found in Worksheet 1, we completed column A of Worksheet 2.

2. Then we examined the Municipal Solid Waste Facilities map (Exhibit 5) provided in the H-GAC regional plan to determine what solid waste services were available in adjacent counties. The purpose of this was to determine the number of people in other areas who would use a fee-based service offered by Montgomery County. The areas where this might occur were highlighted on Exhibit 5.

3. Population data for each of these areas was obtained, and is shown in Exhibit 3. Since sub-areas 4 and 10 are surrounded by other sub-areas within Montgomery County, their additional population from other areas would be 0. Therefore, 0 was recorded in Column B of Worksheet 2 for sub-areas 4 and 10. Since sub-areas 2 and 3 are adjacent to an area of Harris County where several MSW services are provided, these areas also received a 0 in Column B of Worksheet 2. Sub-areas 1, 5, 6, 7, 8, and 9 all have out-of-county areas that would draw users of a new MSW service.

   1990 Census Tract maps were obtained from H-GAC for Liberty County (Exhibit 6), Harris County (Exhibits 7 and 8), Waller County (Exhibit 9), and Walker County (Exhibit 10). The population data for each census block was transferred to these maps. Since Grimes County and San Jacinto County are in different COGs, their information was obtained from the website http://venus.census.gov. The data and map for San Jacinto County are shown as Exhibit 11 and the same information for Grimes County is shown as Exhibit 12.

4. The estimated population for sub-areas 1, 5, 6, 7, 8, and 9 were calculated as shown below and placed in Column B of Worksheet 2. It was assumed that a maximum of 25% of the people who could use the services actually would.

Sub-Area 1 - Liberty and Harris Counties (Exhibits 6 & 7):

((2504 / 2) + 2786 + 6165) * 0.25 = 2551

Sub-Area 5 - San Jacinto County (Exhibit 11):

(9996 / 4) * 0.25 = 625

Sub-Area 6 - Harris and Waller Counties (Exhibits 8 & 9):

(2582 + 2245 + 4728 + 6592 + 975 + 2959) * 0.25 = 5020

Sub-Area 7 - Grimes County (Exhibit 12):

((5441 / 2) + (8311 / 2)) * 0.25 = 1719

Sub-Area 8 - Grimes and Walker Counties (Exhibits 12 & 10):

((5076 / 4) + (5681 / 4)) * 0.25 = 672

Sub-Area 9 - Walker and San Jacinto Counties (Exhibits 10 & 11)):

((5862 / 4) + (9996 / 4)) * 0.25 = 991

5. Column C in Worksheet 2 was completed by adding Column A to Column B for each sub-area.

6. The average disposal rate in Montgomery County is 7.32 pounds per person as determined in a previous study performed for the county. This number was placed in all rows of Column D in Worksheet 2.

7. The estimated volume for each sub-area is determined by multiplying Column C by Column D and placing the result in Column E of Worksheet 2 for each sub-area.

8. Column E is then divided by 2000 and the result is placed in Column F for each sub-area.

9. Determining the percent recycling reduction rate required knowledge about the waste stream of the community, or assumptions about recycling by the general population. Since sub-areas 3 & 4 are in The Woodlands area and have curbside recycling and a recycling drop-off center, they will have greater reduction rates than the other sub-areas in Montgomery County, which are assumed to be consistent. Typical waste composition rates are taken from Table 25 of the text.

   The reduction rate in sub-areas 1, 2, and 5-10 are calculated by reducing the waste stream for only yard waste and paper recycling. Yard waste is removed from the waste stream in Montgomery County in large quantities due to the composting facilities and the ability to burn yard waste in rural areas. Studies have shown that the yard waste make-up of Montgomery County's waste is only 2.5%. Since the typical waste stream has 15.9% yard waste, there is an assumed 13.4% reduction for yard waste in Montgomery County. Paper is also heavily recycled due to the presence of paper recycling collection bins throughout the county. Paper generally makes up 41.07% of a waste stream. Assuming that 30% of the paper generated in Montgomery County is recycled, then multiplying 0.3 by 0.4107, 12.32% of paper is removed from the waste stream in Montgomery County due to recycling. Therefore, sub-areas 1, 2, and 5-10 have a 13.4% plus a 12.3% reduction rate, or a 25.7% total recycling reduction rate. This amount was placed in Column G of Worksheet 2 for sub-areas 1, 2, 5, 6, 7, 8, 9, and 10.

   The Woodlands recycling reduction will include additional paper reduction, as well as glass, metal and plastic reductions. We assumed that an additional 20% of the paper will be recycled for a total paper reduction rate of 50% or 20.5% of the total waste stream. Glass reduction is assumed to be 10% of glass or 0.1 times 0.5 (typical percent of glass in total waste stream) equaling 0.05% of the total waste stream. Metal reduction is assumed to be 10% of metal or 0.1 times 0.8 (typical percent of metal in total waste stream) equaling 0.08% of the total waste stream. Plastic reduction is assumed to be 10% of plastic or 0.1 times 0.9 (typical percent of plastic in total waste stream) equaling 0.09% of total waste stream. Yard waste reduction is assumed to remain at 13.4% of the total waste stream. Therefore, the recycling reduction rate for sub-areas 3 and 4 is the total of these individual reduction rates, or 20.5% plus 0.05% plus 0.08% plus 0.09% plus 13.4%. The total reduction rate is 34.12%. This was placed in Column G of Worksheet 2 for sub-areas 3 and 4.

10. To obtain a non-participation rate, a survey of citizens should be taken to determine what percentage would use a CCS. This was not feasible as part of this study so we contacted a local hauling company in Montgomery County to ask what figure they use. This information was not available from the local hauling companies. Therefore, educated assumptions had to be made. Sub-areas containing The Woodlands and Conroe were assumed to only have a participation rate of 20% since the areas are mostly serviced by private hauling companies, but create a significant amount of waste from new homebuilding. Rural areas are assumed to have participation rates of 50%. These numbers were placed in Column H of Worksheet 2 for each sub-area.

11. Column I on Worksheet 2 was calculated as demonstrated on the worksheet for each sub-area.

12. The peaking factor was taken from Table 26 in the text, and placed in Column J of Worksheet 2.

13. Columns K through O were calculated as demonstrated on the worksheet.

STEP 4: Project Future Waste Generation Volumes

Using Worksheet 3, Montgomery County projected waste generation volumes for the next fifteen years were calculated as follows:

1. Daily volumes for each sub-area were transferred from Column I of Worksheet 2 to Worksheet 3a in tons. Weekly, monthly, and annual average volumes were calculated using the formulas shown on the worksheet.

2. The annual volumes were then transferred from Worksheet 3a to the "Year 0" column on Worksheet 3b for each sub-area. The population growth rate for each area was determined in Table 33 of the text. These percentages were transferred to Worksheet 3b. The projections were calculated using the formulas shown on the worksheet.

STEP 5: Determine Needs of Sub-Areas

Copies of Worksheet 4 were sent to the administrative assistants of the County Commissioners in Montgomery County to be completed and returned for evaluation. The evaluation included reviewing the answers, totaling the scores, and determining the needs of each sub-area. Bar charts were shaded to show the results of each.

STEP 6: Identify Existing Solid Waste Services and Determine Additional Needs

Using Worksheet 5, we identified the solid waste infrastructure present in Montgomery County. The evaluation worksheets and the H-GAC provided facility map assisted in completing this worksheet. Locations of each facility were plotted on a county map (Exhibit 13) to assist in determining service area of each facility. The table was then marked with "X's" using the information we had found. We then contacted existing solid waste service providers for disposal rates. This was only provided to us in cost-per-volume or cost-per-customer. This information was collected and converted to cost-per-capita using the method shown in Exhibit 14. The cost-per-capita data was then placed in the table in Worksheet 5. Commercial collection was not considered in this evaluation and recycling was considered to be offered at no cost to the operators of the recycling centers.

The additional solid waste infrastructure needs of Montgomery County were determined using Worksheet 6. The worksheet was completed by comparing Worksheets 4 and 5. The resulting needs were placed in the provided table. To make this comparison easier, the needs from Worksheet 4 were plotted on Exhibit 15.

STEP 7: Determine Cost-Per-Capita of Existing Solid Waste System

Using Worksheet 7, we determined the cost-per-capita of existing solid waste systems in Montgomery County. The first step in this process was categorizing the sub-areas as urban or rural. Sub-areas 3 and 10 were classified as urban, and the remainder were considered rural.

Then we estimated the percentage of population in each sub-area who used the various disposal methods: direct landfilling, residential collection, other, and illegal dumping. Next, we used the percentages to determine the number of people participating in each method in each sub-area. Then, using this information, we multiplied the number of people using a method by its cost-per-capita found in Worksheet 5. By summing the amounts calculated for the individual sub-areas, the total expenditure for each method was determined. This number was then divided by the total population of Montgomery County to determine the per-capita cost for the entire county. An example of these calculations for both a rural and an urban area are provided as Exhibit 16.

Once the existing cost-per-capita was determined for Montgomery County, it was compared to the case study cost-per-capitas using Figure 17. The resulting cost-per-capita for Montgomery County was $34.61. This falls within the boundaries set by the case study results, as shown in Exhibit 17. To determine the value of the comparison of the existing Montgomery County system with the case studies, the checklist provided in Figure 18 was used. The answers to the questions are shown below.

Q. Are the population densities similar?
A. Yes, but Montgomery County has a denser population in some areas.

Q. Is the population make-up similar?
A. No, Montgomery County has a much greater population than the case studies.

Q. Is the government type similar?
A. Yes.

Q. Are services similar?
A. No, Montgomery County does not currently offer many services.

Q. Is the waste stream similar?
A. Yes, the makeup of the waste stream is similar.

Q. Is the waste generation similar?
A. Yes, on a per-capita basis, but the total volume is much larger.

Q. Is the commitment to solid waste services similar?
A. Not at the present time, but there is movement toward that goal.

Q. Are the regulatory requirements similar?
A. Yes.

Q. Is the cost for services similar in my area?
A. Yes, services offered by private companies offer similar rates to the case studies.

Enhancement Option

Administration

Montgomery County currently houses its solid waste administration in many locations. These services are handled individually by each precinct, with a small amount of assistance from the county. The administration of solid waste services should become a countywide position. The existing Health and Environment Department would be the most logical place to house the new department. In order for a true commitment to be placed on solid waste services, at least one person should be committed to this on a full-time basis. The illegal dumping officers should be moved to this department, as well as administration of the collection service offered by Precinct 3 at their precinct barn.

Illegal Dumping Programs

Montgomery County has a very good illegal dumping enforcement program started in portions of the county. This should be expanded to all areas of the county and administered from a single point of contact.

Reduce, Reuse, and Recycling

Portions of Montgomery County have extensive recycling programs in place. Initially this should not be a service offered by the county because it is currently readily available in most portions of the county. Eventually the proposed CCS locations should expand to include acceptance of recyclable materials. Precinct 4 should continue to accept recycles, since it has a successful program in place.

Collection

CITIZENS COLLECTION STATIONS

STEP 8a: Determine if Enhancement Options are Beneficial

Determining the location, design, and layout of the proposed CCSs is the first step in evaluating the addition of them to Montgomery County. Worksheet 4 was used to determine that initially three CCSs should be added to Montgomery County. These should be placed at the Precinct Barns due to the available land and proximity to the areas which need the services. Worksheet 8 was filled out for each of these proposed CCSs to determine the feasibility of each. Before the worksheets could be completed, design and layout issues had to be evaluated.

Using the guideline provided in the text, it was determined that the CCSs should have the following aspects:

- All weather surfaces for roads and access
- Easy access into the site and to the containers for residents
- A perimeter fence
- Convenient hours of operation
- Posted signs
- Easy access for removal of waste containers by employees
- Landscaping to provide a visual buffer
- Exterior lighting
- Water, electric, and sewer utilities

The next step was determining if the CCSs would be manned or unmanned. Evaluating the advantages and disadvantages of each in Figure 20 led to the conclusion that the CCSs should be manned at all times while they are open. The CCSs will only be open 40 hours per week, but the hours will be during convenient times for the public to use the site. A layout of the proposed CCS is shown as Exhibit 18.

The text provided questions that needed to be answered about demographics, infrastructure, and costs. These questions and the answers are shown below.

Q. Who will the users of the CCS be?
A. The citizens of Montgomery County and anyone else willing to pay for the service.

Q. Where will the CCSs be located?
A. Initially, at the Precinct 2, 3, and 4 barns.

Q. What services will the CCS offer?
A. Collection of Type I municipal solid waste and Type IV construction and demolition waste. These will be separated at the CCS for potential savings in disposal.

Q. How will the CCS be laid out?
A. As shown in the proposed layout, Exhibit 18. Option 2 from Figure 19 has been chosen as the layout for the Type IV collection since it offers the ability for contractors to share the space with residents who may not need to spend as much time unloading.

Q. Will the citizens be charged for disposing of materials at the facility?
A. Yes, because the citizens are currently paying for the service. By charging at the facility, a tax increase or other governmental revenue source will not be required.

Q. How will the facility ensure that only specified people are using the facility?
A. This will not be necessary since all users will be required to pay for the services.

Q. Will there by employees at the facility?
A. Yes, the facility will be manned.

Q. Who will be responsible for maintaining and operating the CCS?
A. The County Health and Environment Department.

Q. What volume of material is the CCS expected to receive?
A. This will be determined in Worksheet 8.

Q. Will the collection station accept only loose materials or will a compaction system be in place?
A. Only loose materials will be accepted from the public at CCSs. Type I waste will be compacted at the facility and Type IV waste will be collected in loose bins.

Using Worksheet 8, the cost of adding a CCS was evaluated for each Montgomery County proposed location as shown below:

1. The capital costs for the proposed CCS were determined using Table 26 in the text. Precincts 2 and 4 will share a roll-off vehicle due to the volume created by each. These figures were placed in the appropriate spaces provided on Worksheet 8. Total cost for each item were calculated, as well as a total site preparation cost, total equipment cost, total recycling cost, and total capital cost. The Montgomery County proposed CCSs will not include recycling. This should be added in the future, but not initiated with the stations.

2. Items that will depreciate over time and their costs were transferred to the annual depreciation schedule. The useful life of each was found in Table 28 of the text and transferred to the appropriate location on Worksheet 8. The annual depreciation for each item was calculated by dividing the total cost of that item by the useful life.

3. Vehicle depreciation was calculated by determining the volume in cubic yards that the CCS would handle on average. This calculation was performed for loose and compacted waste because the station is proposed to compact Type I waste and not compact Type IV waste. Local data allows us to assume that 70% of the waste will be Type IV (loose) and 30% will be Type I (compacted). The volume of the collection bin is used to calculate the trips per day that the roll-off truck will need to make. This and the round-trip miles from the collection site to the disposal location are used to calculate the total miles per day the vehicle will travel.

   The CCSs should haul the Type I waste to one of two available facilities. Republic Waste Services operates a transfer station within 30 miles of each of these facilities. Waste Management operates Security Landfill slightly farther away from each of the precinct barns. These locations and routes are shown on Exhibit 19. We recommend that the Type IV waste be hauled to a Type IV landfill located a farther distance than these sites due to lower disposal rates. However, the more conservative Type I rates will be used in this evaluation.

   Multiply the miles per day times the number of days the station will be open to calculate the miles per year. 365 days is used in this calculation rather than the 260 days the facility will be open because 365 days of waste will arrive at the facility in the 260-day time period. The Montgomery County proposed CCSs are expected to be open five days a week, eight hours a day. A truck has a life of 200,000 miles so that is divided by the miles per year to determine the life of the vehicle. The cost of the vehicle divided by the life of the vehicle provided the depreciation of the vehicle.

4. The total annual depreciation is the sum of the depreciable items and the vehicle depreciation.

5. The operating costs include labor, transportation & maintenance, utilities, disposal and recycling costs. The labor at the proposed Montgomery County CCSs will include an attendant and a driver for the roll-off truck. The attendant will work 40 hours at the CCS at a rate of $6 per hour. Precinct 3 will have a full-time driver, while precincts 2 and 4 will share a driver. This is reflected in the hours allotted. The driver will be paid $12 per hour. The total direct cost is totaled and placed in the indirect cost calculation. We assumed that Montgomery County uses a 30% benefit allocation, which is used to determine the indirect cost. The transportation and maintenance calculation uses the total miles calculated in the earlier vehicle depreciation calculation. Utilities are assumed to cost an average of $200 per month. The CCSs will have air conditioners in the attendant station, but water, restroom facilities, and exterior lighting are already present at the precinct barns. Disposal cost utilizes the annual waste volume, calculated in Worksheet 3a. The CCSs should haul the waste to one of two available facilities. Republic Waste Services is the closer of the two facilities and charges $28 per ton for disposal. Facilities that accept only Type IV waste are available in the area, and their rates are less than the transfer station. However, the analysis will take the conservative approach of assuming that all waste will go to the transfer station. Once the total disposal rate is calculated, the total operating cost can be determined.

6. The total annual depreciation and operating cost was then determined by summing these amounts.

7. The population of the service area was transferred from Worksheet 1. Using the population and the previously calculated totals, the total cost-per-capita, total capital investment-per-capita, the total operating expense-per-capita, and the cost-per-ton were calculated.

The fee that citizens will be charged has not been calculated because this decision can only be made by county officials. The maximum fee that would need to be charged for the facility to break-even under the described conditions is $37.44 per ton.

The CCSs should be registered with the TRNCC as required. The regulations are discussed in Section IV of the text.

STEP 9a: Evaluate Enhanced System

The benefit of adding a CCS to an existing solid waste management system is assessed by comparing the additional costs of adding the CCS to the costs no longer spent after the CCS is in place. We computed the costs averted by each of the three proposed CCSs and transferred the total cost to Worksheet 9 using the following method.

We assumed that the CCS would have varying effects on the populations of its service area. In our example, we suggested that citizens who have residential collection in place will not change; they will continue to pay for residential collection, rather than travel to a CCS. Citizens who have historically traveled to landfills are especially likely to use a CCS, and we presumed that 75% of the citizens who currently use a landfill will switch to a CCS. Citizens who have previously used legal methods of waste disposal without charge are possible users of a CCS, and we estimated that 50% of those who currently use legal, independent methods (burning, burial) will switch to a CCS. Citizens who have engaged in illegal dumping are likely to use a CCS to the extent that their illegal dumping is driven by the lack of convenient disposal options, and we presumed that 75% of illegal dumping will be diverted to a CCS.

We determined the service areas of each proposed CCS by considering the CCS location relative to each of the nearby sub-areas. Each CCS was assigned all or part of several sub-areas, based on the size and location of the sub-areas. The waste disposal costs averted by the CCSs were computed first by determining the number of people using a particular waste disposal method who would switch to a CCS and then by multiplying that number of people by the per-capita cost they paid before switching. As an example, the averted costs of landfilling when an entire sub-area is served by a CCS can be computed as 75% multiplied by the number of people in the sub-area who use a landfill multiplied by their per-capita cost to use a landfill. The averted costs of "other" legal, disposal methods are not computed because the citizens' previous per-capita cost was zero. The costs for illegal disposal are paid by the county, and the averted costs for a decrease in illegal dumping are considered by assuming that the county-paid costs decrease by 50%, based on the total population of the service area. All calculations are provided as Exhibit 20.

We computed both total averted costs by CCS and total averted costs, for all three combined, for each category of disposal: landfill and illegal dumping. We transferred the combined totals to Worksheet 9 and computed the cost-per-capita savings based on the assumed effectiveness of the three CCSs taken together. The savings calculated was $7.35 per capita in the areas serviced by the new CCSs.

STEP 10a: Should you Enhance the System?

The cost-per-capita figures calculated for the proposed Montgomery County system were compared to the bar charts provided in Figure 27, to determine that the figure was a reasonable amount. This comparison is shown as Exhibit 21. The existing Montgomery County system only considers the $2 per capita amount currently being spent on illegal dumping. The system was then re-evaluated using the flow chart provided as Figure 25. This re-evaluation is shown as Exhibit 22, and recommends adding the CCS.

TRANSFER STATION

STEP 8b: Determine if Enhancement Options are Beneficial

Determining the location, design, and layout of the proposed transfer station is the first step in evaluating the addition of it to Montgomery County. Worksheet 6 determined that a transfer station is needed to service the same areas as the previously evaluated CCSs. The analysis determined that the second phase of implementation should add a transfer station to Montgomery County. The most logistically viable place is in the Conroe area because it is centrally located to the three CCSs and any future CCSs added to the system, as shown in Exhibit 23. The old City of Conroe landfill would be the perfect location for this transfer station. Worksheet 10 was completed for the proposed transfer station assuming that it would be located at the closed landfill. Before the worksheet could be completed design and layout issues had to be evaluated.

The transfer station will only be open 40 hours per week, but the hours will be during convenient times for the public to use the site. A layout of the proposed transfer station is shown as Exhibit 24. The transfer station will have a CCS located on-site for the safety of residents in the area who will use the transfer station for disposal. As roll-off trucks dispose of waste at the transfer station, they will dump the boxes of waste collected at the transfer station CCS.

Other issues need to be addressed when considering the cost to construct a transfer station. The text provided questions that need to be answered about demographics, infrastructure, and costs. These questions and the answers are shown below.

Q. Who will the users of the transfer station be?
A. The citizens of Montgomery County, the CCSs owned and operated by Montgomery County, and anyone else willing to pay for the service.

Q. Where will the transfer station be located?
A. At the old City of Conroe landfill.

Q. What services will the transfer station offer?
A. Collection of Type I municipal solid waste and Type IV construction and demolition waste.

Q. How will the transfer station be laid out?
A. As shown in the proposed layout, Exhibit 23. Option 1 from Figure 19 has been chosen as the layout for the CCS located at the transfer station.

Q. Will the citizens be charged for disposing of materials at the facility?
A. Yes, because the citizens are currently paying for the service. By charging at the facility, a tax increase or other governmental revenue source will not be required.

Q. How will the facility ensure that only specified people are using the facility?
A. This will not be necessary since all users will be required to pay for the services.

Q. How many employees will there be at the facility?
A. Four, an attendant, a laborer, a front-end loader operator and a transfer trailer driver.

Q. Who will be responsible for maintaining and operating the transfer station?
A. The County Health and Environment Department.

Q. What volume of material is the transfer station expected to receive?
A. This will be determined in Worksheet 10.

Q. Will the collection station accept only loose materials or will compacted materials be accepted at a varying fee?
A. Both loose and compacted materials will be accepted at the transfer station. Compacted Type I waste will be received from the CCSs.

Using Worksheet 10, the addition of a Transfer Station was evaluated for Montgomery County as shown below. The addition of a transfer station will alter the costs previously calculated for the proposed CCSs due to the change in disposal cost and transportation distance. The previously provided worksheet 8s will need to be altered to provide an accurate calculation of disposal costs and distance travelled.

1. The capital costs for the proposed transfer station were determined using Table 26 in the text and a study performed by Malcolm Pirnie (Exhibit 25). These figures were placed in the appropriate spaces provided on Worksheet 10. Total costs for each item were calculated, as well as a total site preparation cost, total equipment cost, total recycling cost, and total capital cost. The Montgomery County proposed transfer station will not include recycling because this service is already offered to many residents by other sources.

2. Items that will depreciate over time and their costs were transferred to the annual depreciation schedule. The useful life of each was found in Table 28 of the text and transferred to the appropriate location on Worksheet 10. Service life of the knuckle-boom and front-end loader are generally calculated in terms of service hours. This analysis will assume a 25-year life for each of these pieces of equipment. The annual depreciation for each item was calculated by dividing the total cost of that item by the useful life.

3. Vehicle depreciation was calculated by determining the volume in cubic yards that the transfer station would handle on average. Only 30% of the waste received at the CCSs will be transferred to the transfer station because the Type IV waste will go to Type IV sites. The volume expected is 24,828 tons of Type I waste, which is divided by 0.2 to determine 124,141 loose cubic yards transferred from the facility. All waste is assumed to be accepted loose because it will be re-compacted in the transfer trailer. The volume of the transfer trailer is used to calculate the trips per day that the transfer truck will need to make to the landfill. This and the round-trip miles from the collection site to the disposal location are used to calculate the total miles per day the vehicle will travel. The volume was evaluated to determine the number of transfer trailers needed and the capital cost was adjusted as needed. The transfer station should haul the waste to Waste Management's Security Landfill, approximately ten miles from the proposed transfer station location.

   Multiply the miles per day times the number of days the station will be open to calculate the miles per year. 365 days is used in the calculation although the transfer station is only open 260 days because 365 days worth of waste will be accepted in the 260 day period. The Montgomery County proposed transfer station is expected to be open five days a week, eight hours a day. A truck has a life of 200,000 miles so that is divided by the miles per year to determine the life of the vehicle. The cost of the vehicle divided by the life of the vehicle provided the depreciation of the vehicle.

4. The total annual depreciation is the sum of the depreciable items and the vehicle depreciation.

5. The operating costs include labor, transportation & maintenance, utilities, disposal and recycling costs. The labor at the proposed Montgomery County transfer station will include an attendant, a laborer, a front-end loader operator, and a transfer truck driver. The attendant and the laborer will work 40 hours per week at a rate of $6 per hour. The front-end loader operator will work 40 hours per week at a rate of $8 per hour. The transfer trailer driver will work 40 hours per week at a rate of $12 per hour. The total direct cost is totaled and placed in the indirect cost calculation. We assumed that Montgomery County uses a 30% benefit allocation, which is used to determine the indirect cost. The transportation and maintenance calculation uses the total miles calculated in the earlier vehicle depreciation calculation. Utilities are assumed to cost an average of $1500 per month. The transfer station will have air conditioners only in the attendant station. Water, sanitary, and electricity for the air conditioning and exterior lighting are included in this number. Disposal cost utilizes the annual waste volume, calculated in Worksheet 3a. The transfer station should haul the waste to Waste Management's Security Landfill. The rate for compacted disposal at this facility is $25 per ton. Once the total disposal rate is calculated, the total operating cost can be determined.

6. The total annual depreciation and operating cost was then determined by summing these amounts.

7. The population of the service area was transferred from Worksheet 1. The transfer station will serve all three CCS populations plus one-half the population of sub-area 5 and one-fourth the population of sub-area 10. Using the population and the previously calculated totals, the total cost-per-capita, total capital investment-per-capita, the total operating expense-per-capita, and the cost-per-ton were calculated.

The fee that users of the facility will be charged has not been calculated because this decision can only be made by county officials. The maximum fee that would need to be charged for the facility to break-even under the described conditions is $26.41 per ton.

The transfer station should be designed so that is transfers less than 125 tons per day of waste. This will allow the transfer station to be registered rather than permitted, which is a much less expensive option. The regulations governing a transfer station are discussed in Section IV of the text.

STEP 9b: Evaluate Enhanced System

The benefit of adding a transfer station to an existing solid waste management system is assessed by comparing the additional costs of adding the transfer station to the costs no longer spent after the CCS is in place. A transfer station tends to affect costs in two ways: by decreasing CCS operation costs through improved trucking efficiencies, and by providing a CCS for an area not previously served. We computed the costs averted by a proposed transfer station located in the Conroe-area by evaluating the effect of a CCS at the proposed transfer station. The evaluation of this fourth CCS followed the same technique we used to evaluate the three CCSs for Worksheet 9. Once computed, we transferred the averted costs to Worksheet 11 and computed the cost-per-capita savings. Calculations are provided as Exhibit 26.

STEP 10b: Should you Enhance the System?

The cost-per-capita figures calculated for the adjusted proposed Montgomery County system were compared to the bar charts provided in Figure 27, to determine that the figure was a reasonable amount. This comparison is shown as Exhibit 27. The existing Montgomery County system only considers the $2 per capita amount currently being spent on illegal dumping. The cost incurred for the CCSs only is a maximum of $19.55 per capita. The cost incurred for the transfer station is $25.75 per capita. The system was then re-evaluated using the flow chart provided as Figure 28. This re-evaluation is shown as Exhibit 25.

Although the transfer station is economically viable, it is not logically feasible at this time. All three proposed CCSs are located within a reasonable distance of a disposal facility. The only CCS that would benefit is Precinct 3, but the cost of adding a transfer station is much greater than the benefit it provides to one CCS. Montgomery County should focus on adding a system of CCSs and re-evaluate the need for a transfer station every two years.

Evaluation Worksheets

Evaluation worksheets were performed for Montgomery County and are provided as follows:

Attachment 1 – Worksheet 1: Total Solid Waste System Demographics
Attachment 2 – Worksheet 2: Waste Stream of Sub-Areas
Attachment 3 – Worksheet 3: Annual Waste Stream Projections
Attachment 4 – Worksheet 4: System Evaluation - Infrastructure Needs
Attachment 5 – Worksheet 5: Existing Solid Waste System - Infrastructure
Attachment 6 – Worksheet 6: Additional Services Needed
Attachment 7 – Worksheet 7: System Evaluation - Costs
Attachment 8 – Worksheet 8: Cost of Adding a Citizens Collection Station
Attachment 9 – Worksheet 9: Cost Averted by Adding a Citizens Collection Station
Attachment 10 – Worksheet 10: Cost of Adding a Transfer Station
Attachment 11 – Worksheet 11: Cost Averted by Adding a Transfer Station

Montgomery County Recommendations

The evaluation worksheets determined that strategically located CCSs would be the most economical method of collection in Montgomery County. A transfer station is not currently beneficial but should be re-evaluated after more CCSs are added.

The analysis shows that initially three CCSs placed at the existing county barns in Precincts 2, 3, and 4 will dramatically improve the services offered to citizens at a cost-effective rate of $19.55 per person.

The evaluation shows strong evidence that a CCS would be highly successful in Montgomery County. The existence of a pseudo, unmanned facility at the Precinct 3 barn and the recycling center in Precinct 4 have served as a test case for the addition of CCSs throughout Montgomery County. In addition to being a first step toward combating illegal dumping, the CCS would allow for the separation of municipal waste and construction and demolition waste. C& D materials are generally less expensive to dispose of at a Type IV facility, and a significant portion of the materials can be recycled.

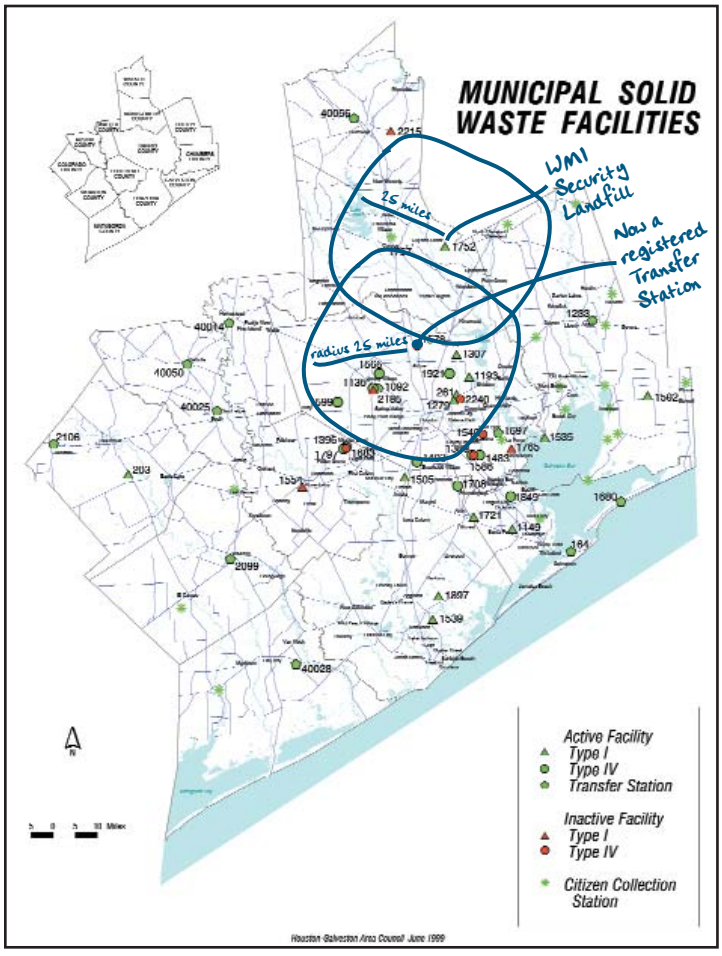
The CCSs could begin as basic stations where Type I and Type IV materials are accepted. The CCSs should be made available to and publicized among both residents and area homebuilders. Eventually the CCSs could expand to include tire and oil collection, recycling and diversion, and household hazardous waste collection.

The long-range plan for Montgomery County should include CCSs located such that rural communities are within ten miles of a disposal facility. However, initially locating CCSs at or near the county barns would be the best option. The county already owns enough property at each of the barns to incorporate a CCS in the existing site plan. These locations are familiar to the public, and would maintain a neat and clean appearance because the County Commissioners' offices are at the barns. Once the three proposed CCSs are implemented, plans should begin for the implementation of additional CCSs. Eventually a transfer station should be added to the system.

The most cost-effective location for a transfer station would be the old City of Conroe landfill. It is both centrally located and available.

A strategically located transfer station would assist in serving the community's municipal solid waste needs. This option would allow for a cost-effective method of properly disposing of Type I waste. Transfer stations are generally cost-effective if there is not a landfill within a 25-mile radius of the service area. Figure 30 shows Waste Management's Security Landfill, the only Type I MSW facility in Montgomery County, and its 25-mile radius. The Montgomery County region enjoys a fairly extensive highway and rail system, which could easily accommodate the transport of the waste materials. Major highways traversing the county include IH-45 and US 59, which run north and south, and SH 242 and SH 105, which run east and west. The use of a privately operated transfer station is another option. Republic Waste operates a transfer station approximately 15 miles from the most problematic area of the county. The location of the transfer station and a 25-mile radius is provided on Figure 30.

Figure 30: Area serviced by an existing landfill in Montgomery County



Eventually Montgomery County should expand its system of CCSs to offer service to all its residents within ten miles of their homes or businesses. Re-evaluations should occur frequently (at least every two years) to determine how the needs have changed and how the new services have altered the system.

Because Montgomery County only has one active landfill, disposal costs are not controllable by the county. If the county were to pursue a new landfill facility, it is recommended that they begin with a Type IV facility where the majority of the county's existing waste stream could be accepted. Type IV facilities are currently less expensive to permit, design, and operate than Type I municipal solid waste facilities. A study performed by Malcolm Pirnie, Inc. in 1994 discusses geological conditions in Montgomery County and recommends potential locations for the siting of a new facility.

Montgomery County should consider developing an integrated solid waste management plan. Private haulers with extended contracts currently transport the majority of waste in the county. The county could work with these entities to implement an integrated solid waste system that would ensure all citizens are serviced. The development of a solid waste management plan would also allow the county to continue to forecast needs and develop and budget for solutions on a long-term basis.

V. EVALUATION WORKSHEETS

Worksheet 1

Total Solid Waste System Demographics

This worksheet delineates a total service area, then divides it into sub-areas. These sub-areas are relatively highly populated, but manageable areas where solid waste services would enhance the community. Detailed directions for completing this worksheet are given below.

Line 1: **Population of Area** - Place the total population of the solid waste coverage area in this line. County and city population information can be obtained from H-GAC if it is not readily available at the county or city offices.

Line 2: **Number of Population Sub-Areas** - Using a census map of the coverage area, divide the overall area into sub-areas based upon population. The following steps should assist in this process.

Step 1: Locate areas of large population clusters (areas with a population greater than approximately 10% of the total population) and mark them on the map, outlining the boundary of the general area.

Step 2: Expand these sub-areas to include the spaces between the population sub-areas. For example, if there are two sub-areas with four miles of area in-between them, expand each of the sub-areas to include the two additional miles closest to them.

Step 3: Determine the total number of sub-areas and place that number in Line 2. There should not be more than ten sub-areas.

Line 3: **Population of Each Sub-Area** - Determine the total population within each sub-area. This can be accomplished by using city population data or census maps. Place the population sub-areas in the spaces provided in Line 3. Total the populations listed in Sub-Areas 1 through 10 and confirm that this total is equivalent to Line 1.

Line 4: **Percentage of Total Population in Each Sub-Area** - For each of the sub-areas listed in Line 3, perform the following percent population calculation and place the results in the respective sub-area section of Line 4.

$$\text{Sub-Area as \% of Total Area} = \frac{\text{Population of Sub-Area (Line 3)}}{\text{Total Population (Line 1)}} \times 100$$

Line 5: **Rank Sub-Areas by Percentages of Total Population** - Using the results obtained in Line 4, rank the percentages from highest to lowest in Line 5.

Worksheet 1

Demographics Of Coverage Area

Line 1:	Population of Area	182,201
Line 2:	Number of Population Sub-Areas	10
Line 3:	Population of Each Sub-Area	
	Sub-Area 1	16,192
	Sub-Area 2	22,805
	Sub-Area 3	35,248
	Sub-Area 4	14,521
	Sub-Area 5	14,039
	Sub-Area 6	17,173
	Sub-Area 7	8,912
	Sub-Area 8	4,989
	Sub-Area 9	13,125
	Sub-Area 10	35,197
	Total (Should Equal Line 1)	182,201
Line 4:	Percentage of Total Population in Each Sub-Area	
	Sub-Area 1	8.9
	Sub-Area 2	12.5
	Sub-Area 3	19.3
	Sub-Area 4	8.0
	Sub-Area 5	7.7
	Sub-Area 6	9.5
	Sub-Area 7	4.9
	Sub-Area 8	2.7
	Sub-Area 9	7.2
	Sub-Area 10	19.3
	Total (Should Equal 1 or 100%)	100
Line 5:	Rank Sub-Areas by Percentages of Total Population	
	Sub-Area (Highest %)	3
	Sub-Area	10
	Sub-Area	2
	Sub-Area	6
	Sub-Area	1
	Sub-Area	4
	Sub-Area	5
	Sub-Area	9
	Sub-Area	7
	Sub-Area (Lowest %)	8

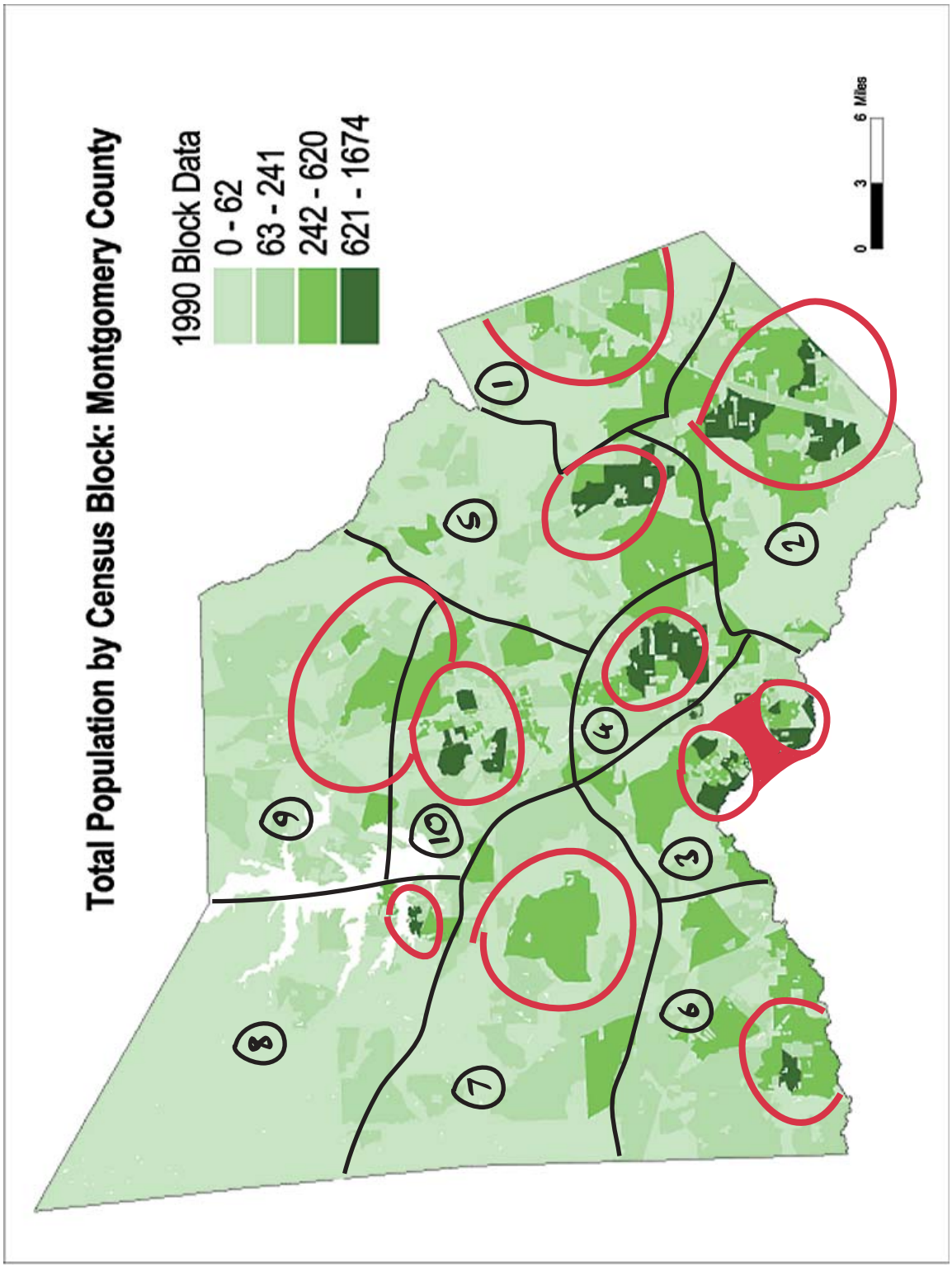

Total Population by Census Block: Montgomery County
1990 Block Data
0 - 62
63 - 241
242 - 620
621 - 1674
0
3
6 Miles
1
2
3
4
5
6
7
8
9
10

Exhibit 1

1992 CENSUS TRACTS

H-GAC REGION

MONTGOMERY COUNTY

LEGEND

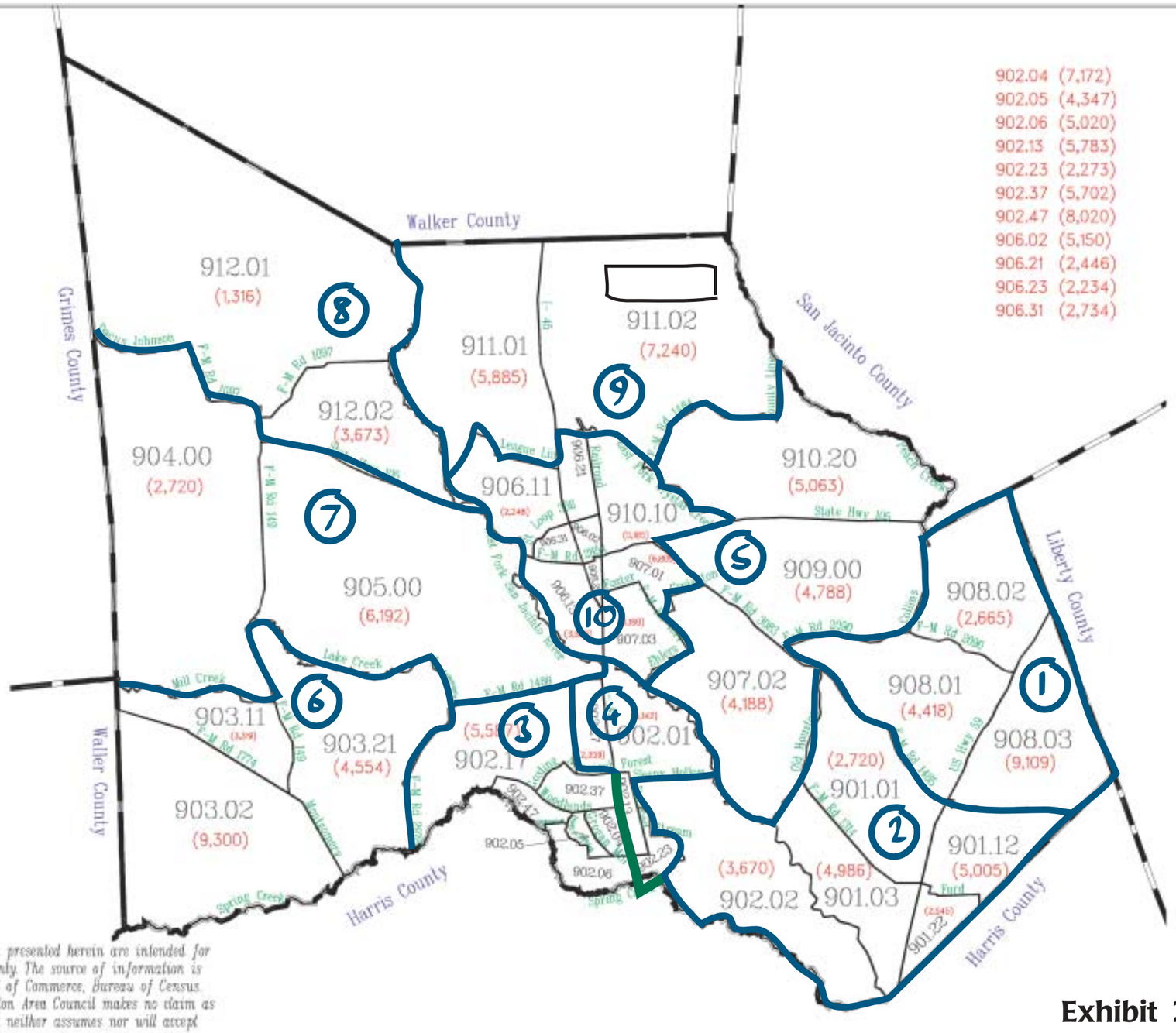
Tracts Boundary

County Line

(5,280) *Population*

H-GAC

Prepared by
Houston-Galveston Area Council
August 1999



The maps and data presented herein are intended for general reference only. The source of information is the U.S. Department of Commerce, Bureau of Census. The Houston-Galveston Area Council makes no claim as to its accuracy and neither assumes nor will accept liability for its use.

Exhibit 2

1992 CENSUS TRACTS

H-GAC REGION

MONTGOMERY COUNTY

LEGEND

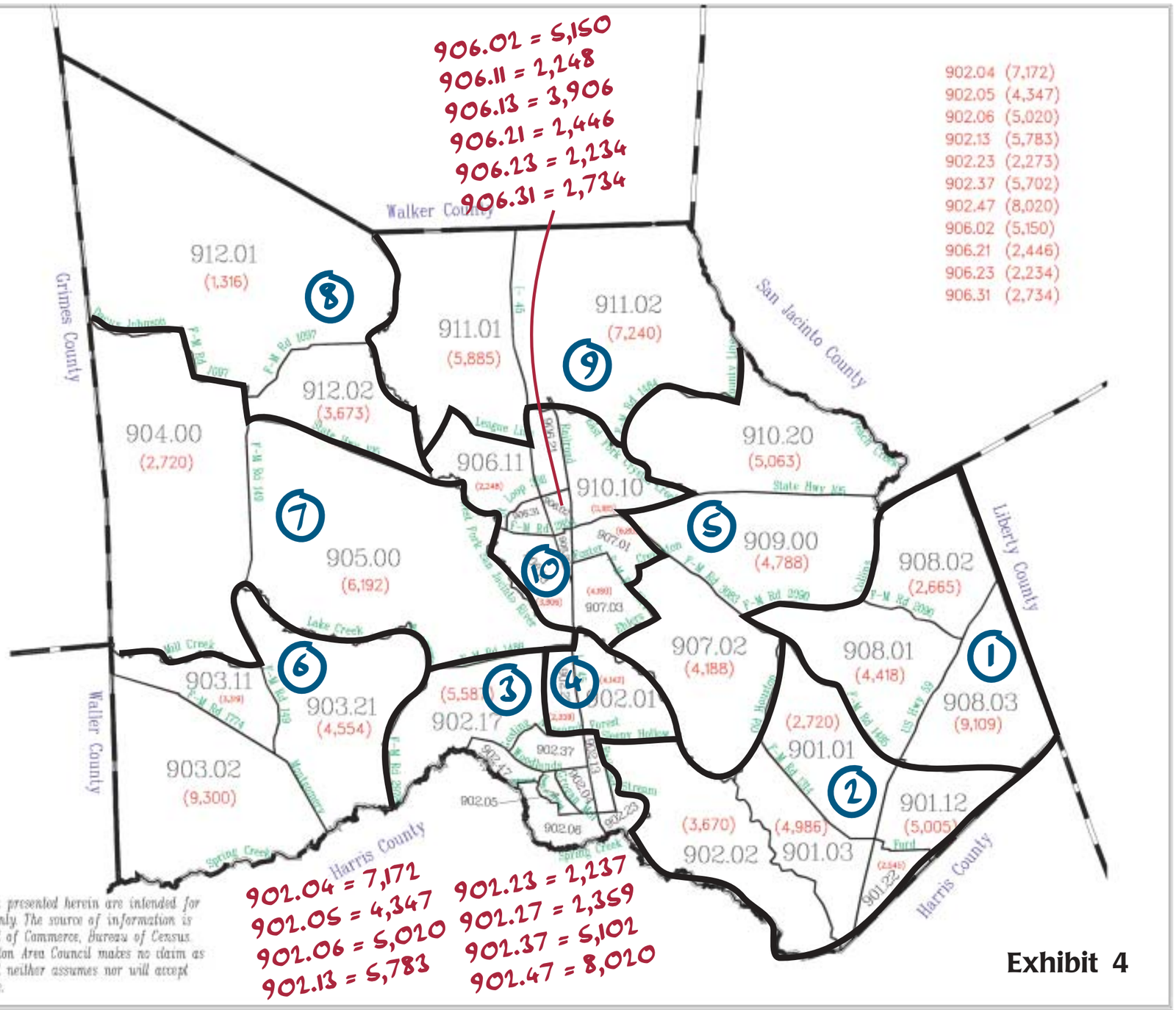
Tracts Boundary

County Line

(5,280) *Population*

HGAC

Prepared by
Houston-Galveston Area Council
August 1999



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902.04 = 7,172
902.05 = 4,347
902.06 = 5,020
902.13 = 5,783
902.23 = 2,237
902.27 = 2,359
902.37 = 5,102
902.47 = 8,020

Exhibit 4

Worksheet 2

Waste Stream Of Sub-Areas

This worksheet provides a step-by-step approach to determining the average solid waste disposal volume generated by each sub-area. This volume will be used in determining which services a community should support and in designing those systems.

Fill in the boxes for each sub-area, progressing from column A to O. Formulas for the boxes requiring a calculation are provided under the headings. More detailed instructions can be found in Section IV: Waste Generation and Waste Stream.

Waste Stream Of Sub-Areas (Per Day)

Worksheet 2

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Sub-Area	Estimated Population	Estimated Population from Other Areas	Total Serviced Population	Average Disposal (Lbs./ Capita)*	Estimated Volume (Lbs.)	Estimated Volume (Tons)	% Recycling Reduction	% Non-Participation Rate	Estimated Disposal Volume (Tons)	Peaking Factor	Volume During Peak Times (Tons)	Estimated Average Disposal Volume (Comp. Cubic Yards)	Estimated Average Disposal Volume (Loose Cubic Yards)	Estimated Peak Disposal Volume (Comp. Cubic Yards)	Estimated Peak Disposal Volume (Loose Cubic Yards)
Formulas					C x D	E/2000			F x (1-G-H)		I x J	1/0.333	1/0.2	K/0.333	K/0.2
1	16,192	2,551	18,743	7.32	137,199	69	0.157	0.5	16.8	2.0	33.6	51	84	101	168
2	22,805	0	22,805	7.32	166,933	84	0.157	0.5	20.4	2.0	40.8	61	102	123	204
3	35,248	0	35,248	7.32	258,015	129	0.3412	0.1	59.2	2.0	118.4	178	296	356	592
4	14,521	0	14,521	7.32	106,294	53	0.3412	0.1	24.3	2.0	48.6	73	122	146	243
5	14,039	625	14,664	7.32	107,341	54	0.157	0.5	13.1	2.0	26.2	39	66	79	131
6	17,173	5,020	22,193	7.32	162,453	81	0.157	0.5	19.7	2.0	39.4	59	99	118	197
7	8,912	1,719	10,631	7.32	77,819	39	0.157	0.5	9.5	2.0	19.0	29	48	57	95
8	4,989	672	5,661	7.32	41,439	21	0.157	0.5	5.1	2.0	10.2	15	26	31	51
9	13,125	991	14,116	7.32	103,319	52	0.157	0.5	12.6	2.0	25.2	38	63	76	126
10	35,197	0	35,197	7.32	257,642	129	0.157	0.1	70.1	2.0	140.2	211	351	421	701

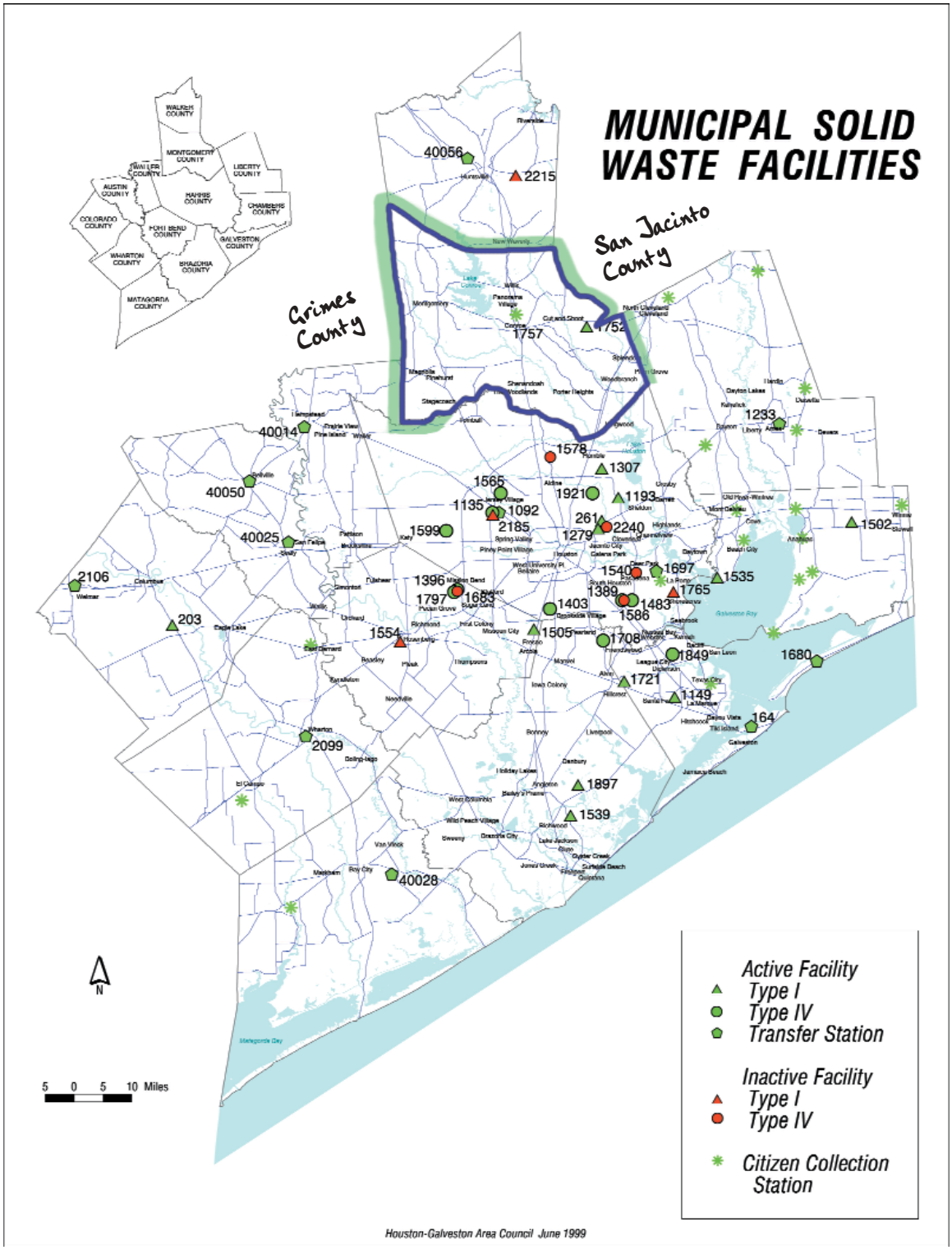
MUNICIPAL SOLID WASTE FACILITIES
San Jacinto County
Grimes County
WALKER COUNTY
MONTGOMERY COUNTY
LIBERTY COUNTY
WALLER COUNTY
AUSTIN COUNTY
HARRIS COUNTY
CHAMBERS COUNTY
COLORADO COUNTY
FORT BEND COUNTY
GALVESTON COUNTY
WHARTON COUNTY
BRAZORIA COUNTY
MATAGORDA COUNTY
40056
2215
1752
1757
40014
1578
1307
40050
1565
1921
1193
1135
1092
2185
261
2240
1279
1599
40025
1502
1233
2106
1396
1797
1683
1540
1697
1535
1765
1389
1403
1483
1586
203
1554
1505
1708
1849
1680
1721
1149
164
2099
1897
1539
40028
5 0 5 10 Miles
N
Active Facility
Type I
Type IV
Transfer Station
Inactive Facility
Type I
Type IV
Citizen Collection Station
Houston-Galveston Area Council June 1999

Exhibit 5

1992 CENSUS TRACTS

H–GAC REGION

LIBERTY COUNTY

LEGEND

Tracts Boundary

County Line

(5,280) *Population*

Prepared by
Houston–Galveston Area Council
August 1999

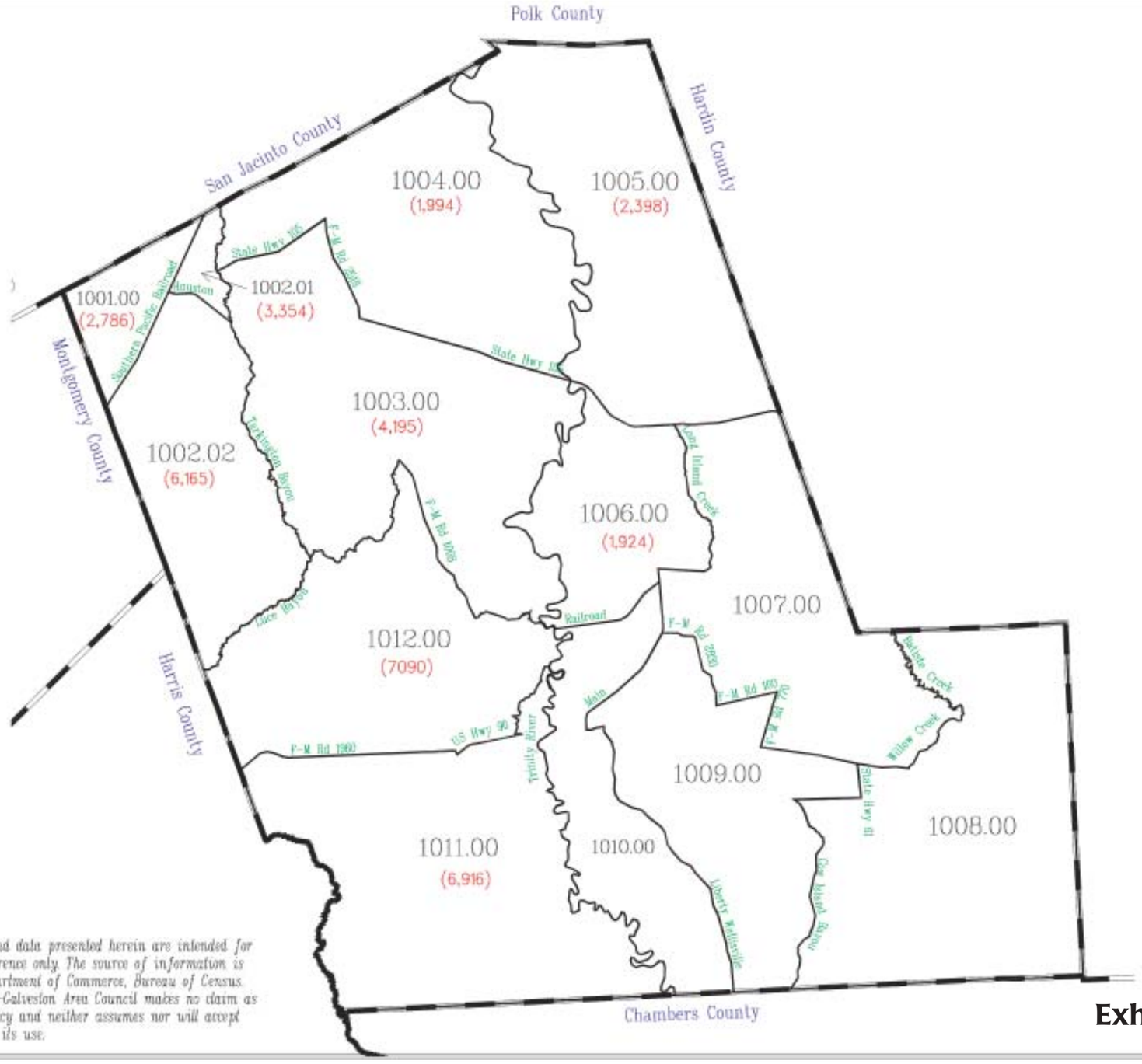

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Exhibit 6

1992 CENSUS TRACTS

H–GAC REGION

HARRIS COUNTY

LEGEND

- Tracts Boundary
- County Line
- (5,280) Population

HGAC

Prepared by
Houston–Galveston Area Council
August 1999

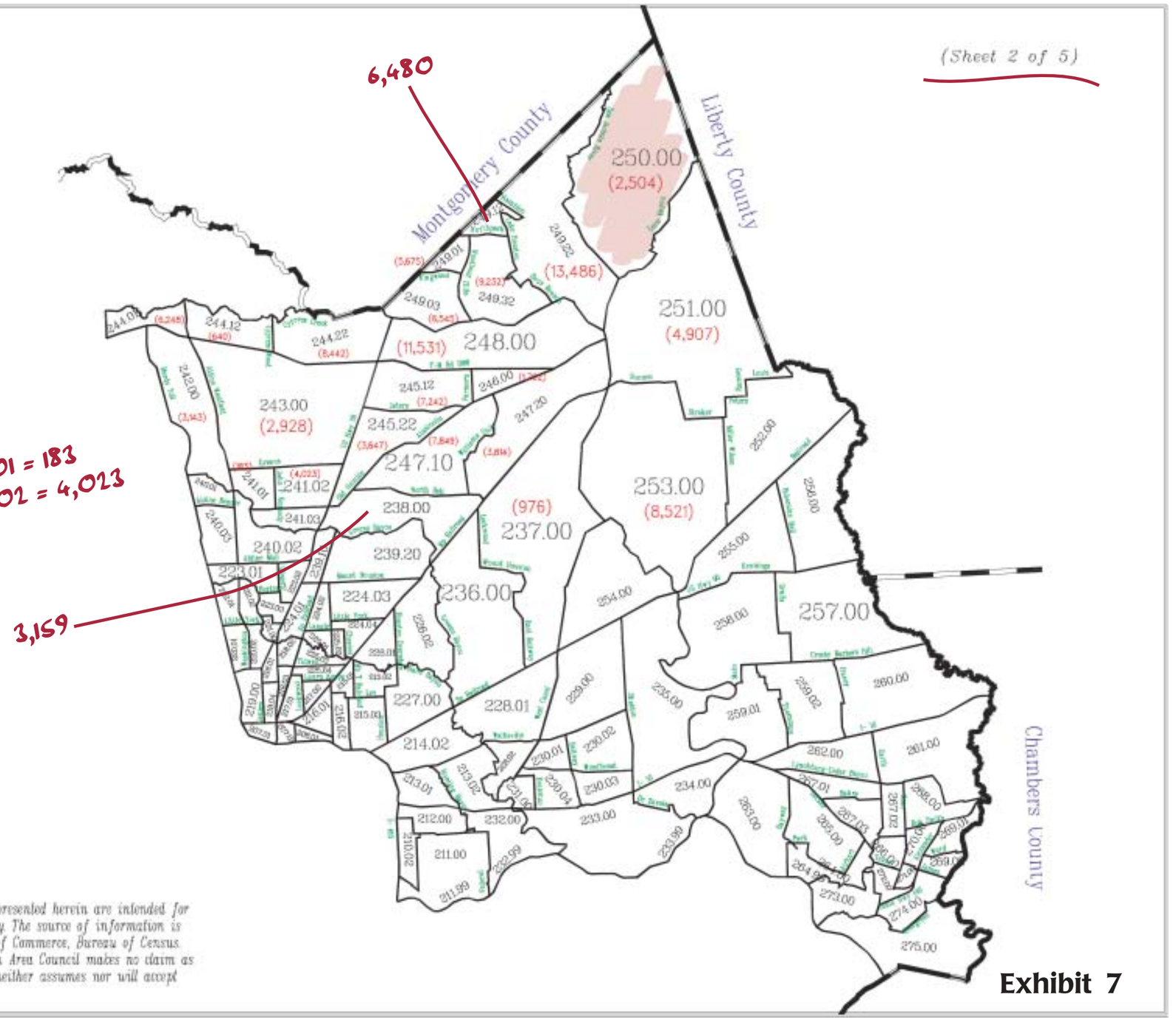

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Exhibit 7

1992 CENSUS TRACTS

H–GAC REGION

HARRIS COUNTY

LEGEND

- *Tracts Boundary*
- *County Line*
- (5,280) *Population*

H-GAC

Prepared by
Houston–Galveston Area Council
August 1999

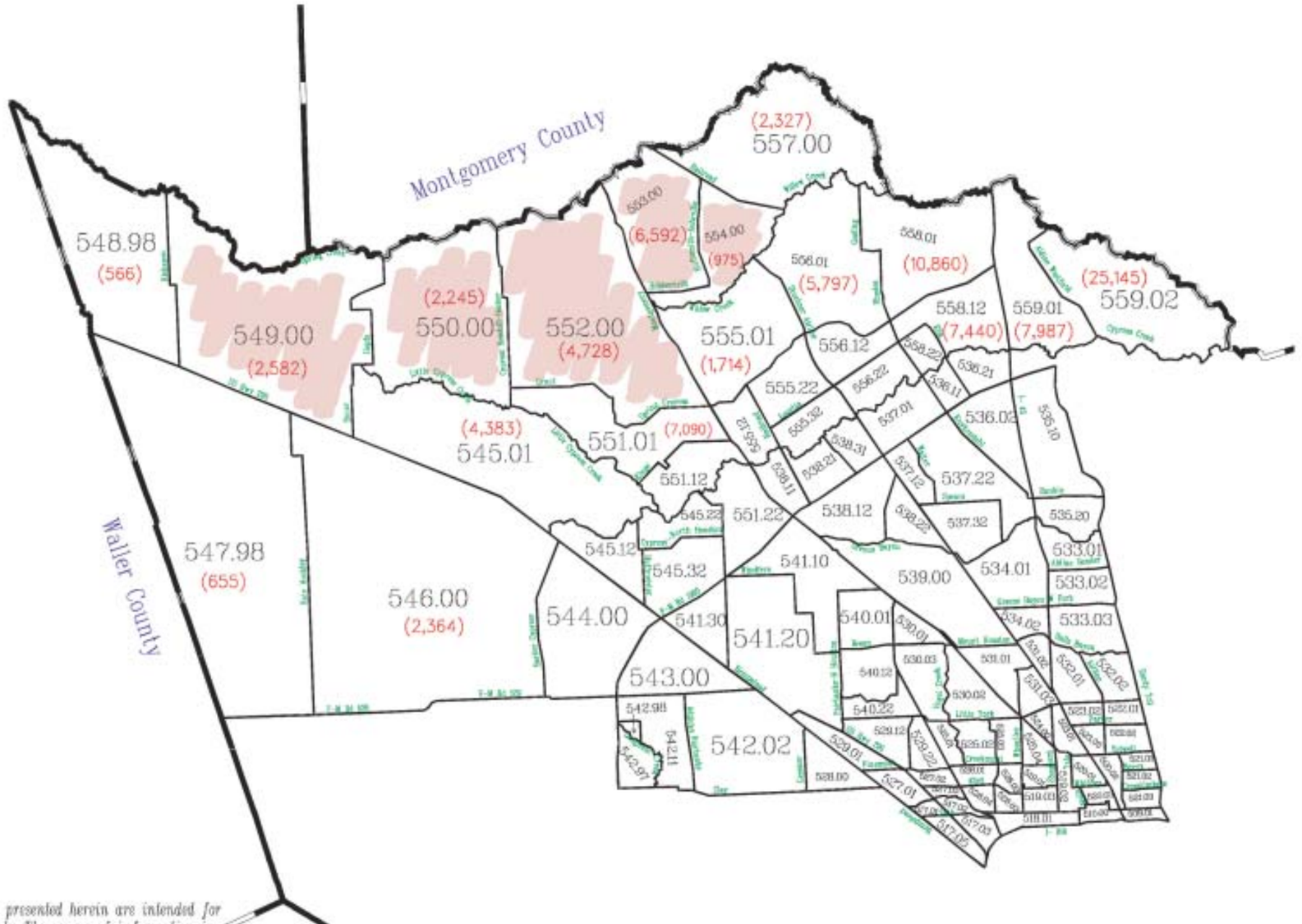

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Exhibit 8

1992 CENSUS TRACTS

H–GAC REGION

WALLER COUNTY

LEGEND

Tracts Boundary

County Line

(5,280) *Population*

H-GAC

Prepared by
Houston–Galveston Area Council
August 1999

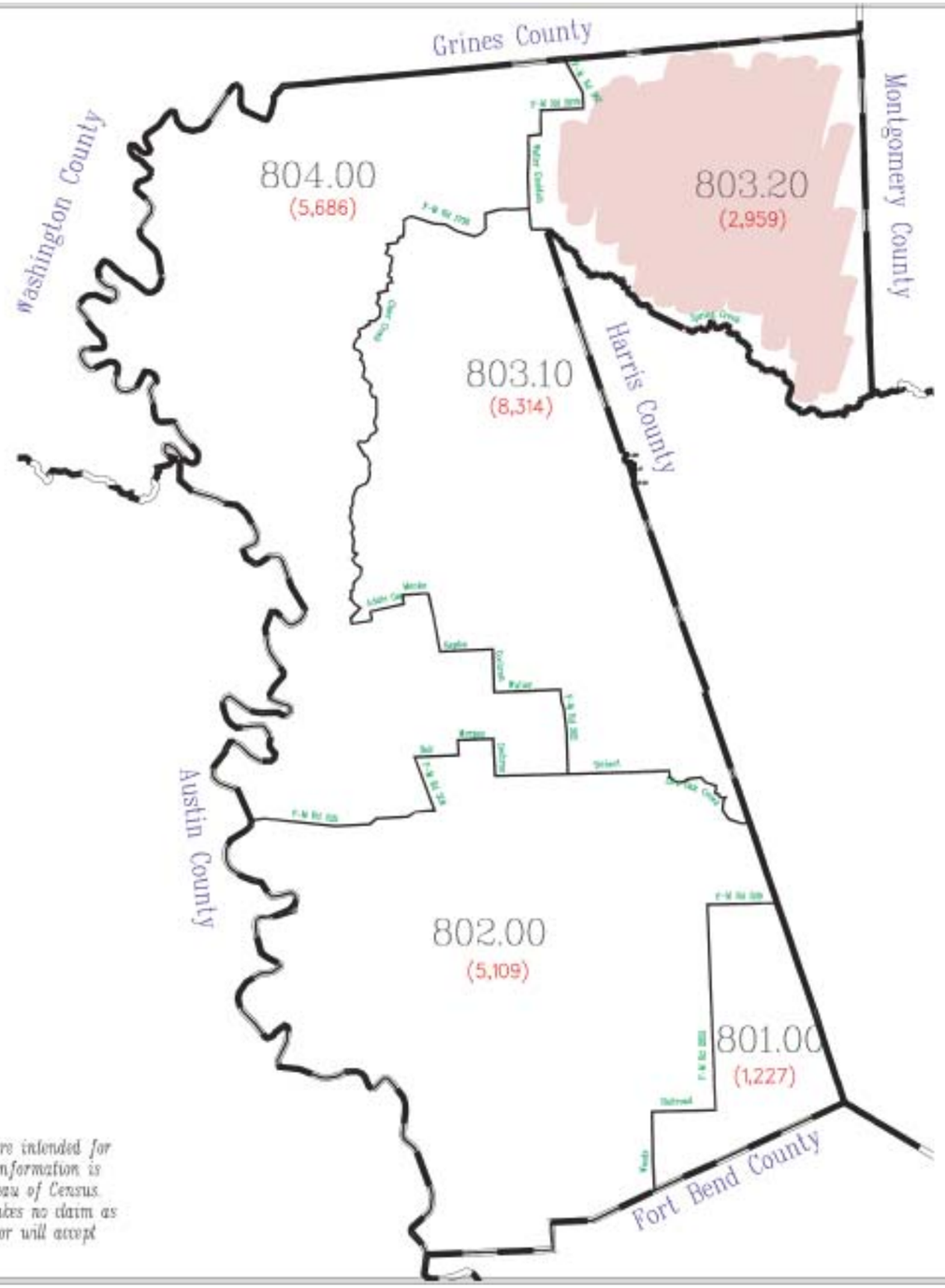

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Exhibit 9

1992 CENSUS TRACTS

H–GAC REGION

WALKER COUNTY

LEGEND

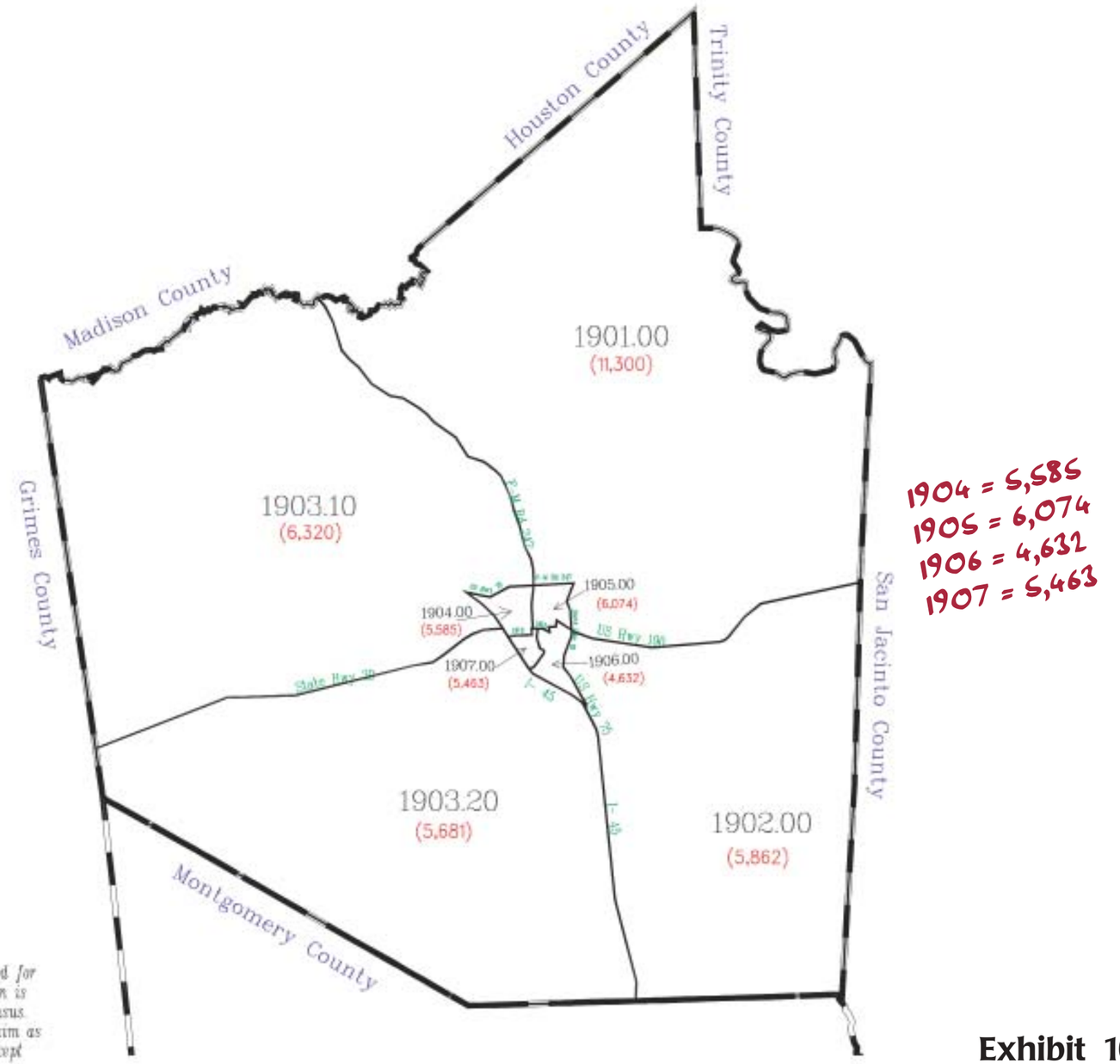
Tracts Boundary

County Line

(5,280) Population

HGAC

Prepared by
Houston–Galveston Area Council
August 1999



1904 = 5,585
1905 = 6,074
1906 = 4,632
1907 = 5,463

Exhibit 10

Worksheet 3

Annual Waste Stream Projections (Tons)

This worksheet converts the volumes calculated in Column I of Worksheet 2 from daily volumes to weekly, monthly, and annual volumes. Once the annual average volume is determined for each sub-area, 15-year projections can be made.

Calculations for conversions to varying time periods are provided below. A sample projection calculation is shown on the worksheet. More detailed instructions can be found in Section IV: Waste Generation and Waste Stream.

Formulas:

Daily Average Volume	x	7 days	=	Weekly Average Volume
Daily Average Volume	x	30.5 days	=	Monthly Average Volume
Monthly Average Volume	x	12 months	=	Annual Average Volume

Average Volumes Of Sub-Areas In Tons

Sub-Area	Daily Average Volume	Weekly Average Volume	Monthly Average Volume	Annual Average Volume
1	16.8	118	512	6,149
2	20.4	143	622	7,466
3	59.2	414	1,806	21,667
4	24.3	170	741	8,894
5	13.1	92	400	4,795
6	19.7	138	601	7,210
7	9.5	67	290	3,477
8	5.1	36	156	1,867
9	12.6	88	384	4,612
10	70.1	491	2,138	25,657

Waste Stream Of Sub-Areas (Per Day)

Worksheet 3

Year		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sub-Area	Population Growth																
1	2.7%	6,149	6,315	6,486	6,661	6,841	7,025	7,215	7,410	7,610	7,815	8,026	8,243	8,465	8,694	8,929	9,170
2	2.7%	7,466	7,668	7,875	8,087	8,306	8,530	8,760	8,997	9,240	9,489	9,745	10,008	10,279	10,556	10,841	11,134
3	11.4%	21,667	24,137	26,889	29,954	33,369	37,173	41,410	46,131	51,390	57,249	63,775	71,045	79,145	88,167	98,218	109,415
4	11.4%	8,894	9,908	11,037	12,296	13,697	15,259	16,998	18,936	21,095	23,500	26,179	29,163	32,488	36,191	40,317	44,913
5	2.7%	4,795	4,924	5,057	5,194	5,334	5,478	5,626	5,778	5,934	6,094	6,259	6,428	6,601	6,780	6,963	7,151
6	2.7%	7,210	7,405	7,605	7,810	8,137	8,460	8,688	8,923	9,164	9,411	9,665	9,926	10,194	10,469	10,752	11,042
7	2.7%	3,477	3,571	3,667	3,766	3,868	3,971	4,080	4,190	4,303	4,419	4,538	4,661	4,787	4,916	5,049	5,185
8	2.7%	1,867	1,917	1,969	2,022	2,077	2,133	2,191	2,250	2,311	2,373	2,437	2,503	2,570	2,640	2,711	2,784
9	2.7%	4,612	4,737	4,864	4,996	5,131	5,269	5,411	5,558	5,708	5,861	6,020	6,183	6,349	6,521	6,697	6,878
10	50%	25,657	26,940	28,287	29,701	31,186	32,746	34,383	36,101	37,907	39,801	41,793	43,881	46,076	48,380	50,799	53,339

System Evaluation - Infrastructure Needs

Sub-Area 1 & 2

This worksheet will assist in evaluating the needs of each sub-area (a separate Worksheet 4 is provided for each of the possible ten sub-areas). Point values are assigned to answers for each question on the worksheet. Summing these values allows the user to quantitatively evaluate solid waste needs. More detailed instructions can be found in Section IV: Solid Waste Infrastructure.

To determine the needs of each area, several things must be considered for each type of infrastructure. Circle the appropriate answer for each evaluation question below. After answering all questions, total the scores associated with each answer and place them in the appropriate space.

Landfill / Incineration (or other "Final" Disposal) Considerations

Yes	No	
(0)	2	Is a final disposal location available within a reasonable distance from the last point of collection (100 miles in one direction)?
(0)	1	Does this final disposal location provide reasonable rates for disposal?
3	(0)	Does my governmental entity have the resources to support such a venture?
1	(0)	Does my governmental entity have the desire to maintain total control of disposal of municipal wastes generated by our citizens?
0	(2)	Are the citizens of this sub-area served by an entity that provides its own disposal services currently (a private company who prefers to use their own landfills)?
3	(0)	Is there a true need for this? NOTE: There is rarely a need for a governmental entity that does not already operate a "final" disposal location to begin operating one. Permitting and construction costs typically far exceed the costs related with other viable options like transfer stations.

Total Points 2

Citizens Collection Station Considerations

Yes	No	
(3)	0	Is there an illegal dumping problem in the sub-area?
(0)	2	Are the residents and businesses in this sub-area offered collection services, and therefore would not have a need for such a center?
0	(1)	Does the collection service offer heavy trash services, such that there would never be a need for a collection station?
0	(2)	Is there already a location where citizens can dispose their waste (such as a landfill or transfer station) within 10 miles?
(3)	0	Would citizens use the citizens collection station?

Total Points 9

Transfer Station Considerations

Yes	No	
2	(0)	Is my existing system paying too much for transportation and disposal of solid waste because the "final" disposal location is a long distance (greater than 25 miles in each direction)?
(1)	0	Have my existing collection needs exceeded the existing collection abilities?
1	(0)	Are there other entities in the sub-areas that currently use private services that would be interested in partnering to decrease transportation costs?
1	(0)	Is there a private company that would be interested in owning and operating a transfer station in my area?
0	(3)	Would the citizens of my area oppose a transfer station?
(4)	0	Are there customers (CCS locations) that will bring waste to the transfer station?

Total Points 8

Recycling Center Considerations

Yes	No	
(1)	0	Is there the desire for recycling services in my area?
(0)	1	Is there an existing private recycling program in my area?
(1)	0	Would recycling services be used by the citizens in this area?
(5)	0	Is there an available means of reuse for these recyclables and a company who would be willing to take them?
(2)	0	Are the resources available to support a recycling program?

Total Points 9

Residential Collection Services

Yes	No	
(1)	0	Is the population density such that individual disposal of waste is a problem?
0	(2)	Are residents willing to contract for disposal of their own waste, or is it being illegally disposed of?
(0)	2	Are private services available?
0	(1)	Are residents happy with the current services?
(2)	0	Is residential waste currently being illegally dumped?
(2)	0	Would residents be willing to pay a fee to fund residential collection services?

Total Points 8

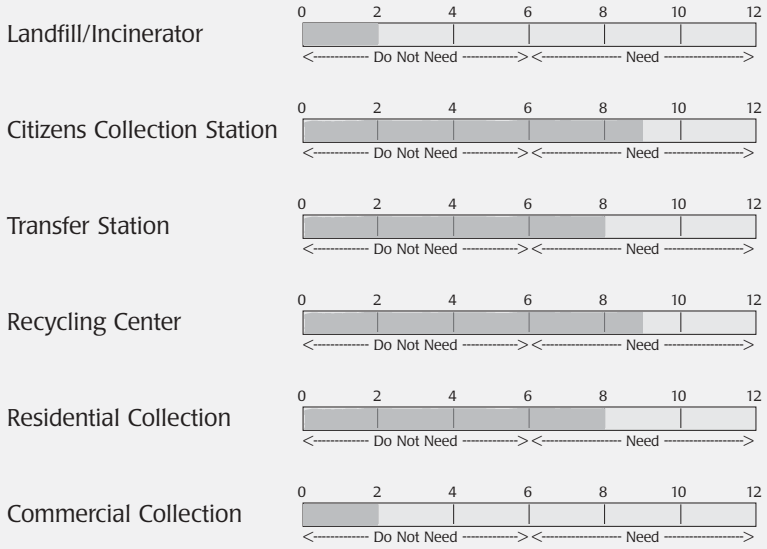
Commercial Collection Services

Yes	No	
(1)	0	Is the commercial density such that businesses are not able to adequately dispose of their own waste?
(0)	2	Are businesses willing to contract for disposal of their own waste?
(1)	0	Is commercial waste being illegally dumped?
(0)	2	Are private services available for commercial collection?
(0)	1	Are commercial collection customers happy with their existing service?

Total Points 2

Needs Of Each Sub-Area

Sub-Area	Landfill/ Incinerator	Citizens Collection Station	Transfer Station	Recycling Center	Residential Collection	Commercial Collection
Total Points from Questions	2	9	8	9	8	2



System Evaluation - Infrastructure Needs

Sub-Area 3

This worksheet will assist in evaluating the needs of each sub-area (a separate Worksheet 4 is provided for each of the possible ten sub-areas). Point values are assigned to answers for each question on the worksheet. Summing these values allows the user to quantitatively evaluate solid waste needs. More detailed instructions can be found in Section IV: Solid Waste Infrastructure.

To determine the needs of each area, several things must be considered for each type of infrastructure. Circle the appropriate answer for each evaluation question below. After answering all questions, total the scores associated with each answer and place them in the appropriate space.

Landfill / Incineration (or other "Final" Disposal) Considerations

Yes	No	
(0)	2	Is a final disposal location available within a reasonable distance from the last point of collection (100 miles in one direction)?
(0)	1	Does this final disposal location provide reasonable rates for disposal?
(3)	0	Does my governmental entity have the resources to support such a venture?
(1)	0	Does my governmental entity have the desire to maintain total control of disposal of municipal wastes generated by our citizens?
(0)	2	Are the citizens of this sub-area served by an entity that provides its own disposal services currently (a private company who prefers to use their own landfills)?
3	(0)	Is there a true need for this? NOTE: There is rarely a need for a governmental entity that does not already operate a "final" disposal location to begin operating one. Permitting and construction costs typically far exceed the costs related with other viable options like transfer stations.

Total Points 4

Citizens Collection Station Considerations

Yes	No	
(3)	0	Is there an illegal dumping problem in the sub-area?
(0)	2	Are the residents and businesses in this sub-area offered collection services, and therefore would not have a need for such a center?
0	(1)	Does the collection service offer heavy trash services, such that there would never be a need for a collection station?
0	(2)	Is there already a location where citizens can dispose their waste (such as a landfill or transfer station) within 10 miles?
(3)	0	Would citizens use the citizens collection station?

Total Points 9

Transfer Station Considerations

Yes	No	
(2)	0	Is my existing system paying too much for transportation and disposal of solid waste because the "final" disposal location is a long distance (greater than 25 miles in each direction)?
(1)	0	Have my existing collection needs exceeded the existing collection abilities?
1	(0)	Are there other entities in the sub-areas that currently use private services that would be interested in partnering to decrease transportation costs?
(1)	0	Is there a private company that would be interested in owning and operating a transfer station in my area?
0	(3)	Would the citizens of my area oppose a transfer station?
(4)	0	Are there customers (CCS locations) that will bring waste to the transfer station?

Total Points 11

Recycling Center Considerations

Yes	No	
(1)	0	Is there the desire for recycling services in my area?
(0)	1	Is there an existing private recycling program in my area?
(1)	0	Would recycling services be used by the citizens in this area?
5	(0)	Is there an available means of reuse for these recyclables and a company who would be willing to take them?
(2)	0	Are the resources available to support a recycling program?

Total Points 4

Residential Collection Services

Yes	No	
1	(0)	Is the population density such that individual disposal of waste is a problem?
0	(2)	Are residents willing to contract for disposal of their own waste, or is it being illegally disposed of?
(0)	2	Are private services available?
(0)	1	Are residents happy with the current services?
(2)	0	Is residential waste currently being illegally dumped?
2	(0)	Would residents be willing to pay a fee to fund residential collection services?

Total Points 4

Worksheet 4

Commercial Collection Services

Yes No

1 **0** Is the commercial density such that businesses are not able to adequately dispose of their own waste?

0 2 Are businesses willing to contract for disposal of their own waste?

1 0 Is commercial waste being illegally dumped?

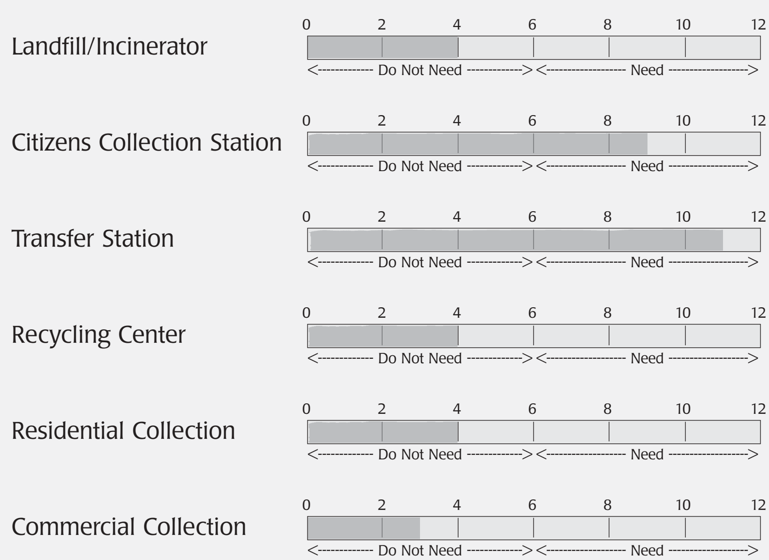
0 **2** Are private services available for commercial collection?

0 1 Are commercial collection customers happy with their existing service?

Total Points 3

Needs Of Each Sub-Area

Sub-Area	Landfill/ Incinerator	Citizens Collection Station	Transfer Station	Recycling Center	Residential Collection	Commercial Collection
Total Points from Questions	4	9	11	4	4	3



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System Evaluation - Infrastructure Needs

Sub-Area 4

This worksheet will assist in evaluating the needs of each sub-area (a separate Worksheet 4 is provided for each of the possible ten sub-areas). Point values are assigned to answers for each question on the worksheet. Summing these values allows the user to quantitatively evaluate solid waste needs. More detailed instructions can be found in Section IV: Solid Waste Infrastructure.

To determine the needs of each area, several things must be considered for each type of infrastructure. Circle the appropriate answer for each evaluation question below. After answering all questions, total the scores associated with each answer and place them in the appropriate space.

Landfill / Incineration (or other "Final" Disposal) Considerations

Yes	No	
(0)	2	Is a final disposal location available within a reasonable distance from the last point of collection (100 miles in one direction)?
(0)	1	Does this final disposal location provide reasonable rates for disposal?
3	(0)	Does my governmental entity have the resources to support such a venture?
1	(0)	Does my governmental entity have the desire to maintain total control of disposal of municipal wastes generated by our citizens?
(0)	2	Are the citizens of this sub-area served by an entity that provides its own disposal services currently (a private company who prefers to use their own landfills)?
3	(0)	Is there a true need for this? NOTE: There is rarely a need for a governmental entity that does not already operate a "final" disposal location to begin operating one. Permitting and construction costs typically far exceed the costs related with other viable options like transfer stations.

Total Points 0

Citizens Collection Station Considerations

Yes	No	
(3)	0	Is there an illegal dumping problem in the sub-area?
(0)	2	Are the residents and businesses in this sub-area offered collection services, and therefore would not have a need for such a center?
(0)	1	Does the collection service offer heavy trash services, such that there would never be a need for a collection station?
(0)	2	Is there already a location where citizens can dispose their waste (such as a landfill or transfer station) within 10 miles?
3	(0)	Would citizens use the citizens collection station?

Total Points 3

Transfer Station Considerations

Yes	No	
2	(0)	Is my existing system paying too much for transportation and disposal of solid waste because the "final" disposal location is a long distance (greater than 25 miles in each direction)?
1	(0)	Have my existing collection needs exceeded the existing collection abilities?
1	(0)	Are there other entities in the sub-areas that currently use private services that would be interested in partnering to decrease transportation costs?
1	(0)	Is there a private company that would be interested in owning and operating a transfer station in my area?
0	(3)	Would the citizens of my area oppose a transfer station?
4	(0)	Are there customers (CCS locations) that will bring waste to the transfer station?

Total Points 3

Recycling Center Considerations

Yes	No	
(1)	0	Is there the desire for recycling services in my area?
0	(1)	Is there an existing private recycling program in my area?
(1)	0	Would recycling services be used by the citizens in this area?
5	(0)	Is there an available means of reuse for these recyclables and a company who would be willing to take them?
2	(0)	Are the resources available to support a recycling program?

Total Points 3

Residential Collection Services

Yes	No	
1	(0)	Is the population density such that individual disposal of waste is a problem?
(0)	2	Are residents willing to contract for disposal of their own waste, or is it being illegally disposed of?
(0)	2	Are private services available?
(0)	1	Are residents happy with the current services?
(2)	0	Is residential waste currently being illegally dumped?
2	(0)	Would residents be willing to pay a fee to fund residential collection services?

Total Points 2

Commercial Collection Services

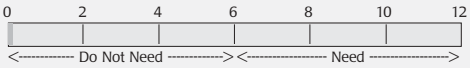
Yes	No	
1	(0)	Is the commercial density such that businesses are not able to adequately dispose of their own waste?
(0)	2	Are businesses willing to contract for disposal of their own waste?
(1)	0	Is commercial waste being illegally dumped?
(0)	2	Are private services available for commercial collection?
(0)	1	Are commercial collection customers happy with their existing service?

Total Points 1

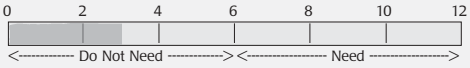
Needs Of Each Sub-Area

Sub-Area	Landfill/ Incinerator	Citizens Collection Station	Transfer Station	Recycling Center	Residential Collection	Commercial Collection
Total Points from Questions	0	3	3	3	2	1
Gauge	6	5	6	5	5	3
Need? "Yes" or "No"	No	No	No	No	No	No

Landfill/Incinerator



Citizens Collection Station



Transfer Station

Recycling Center

Residential Collection

Commercial Collection

Worksheet 4

System Evaluation - Infrastructure Needs

Sub-Area S

This worksheet will assist in evaluating the needs of each sub-area (a separate Worksheet 4 is provided for each of the possible ten sub-areas). Point values are assigned to answers for each question on the worksheet. Summing these values allows the user to quantitatively evaluate solid waste needs. More detailed instructions can be found in Section IV: Solid Waste Infrastructure.

To determine the needs of each area, several things must be considered for each type of infrastructure. Circle the appropriate answer for each evaluation question below. After answering all questions, total the scores associated with each answer and place them in the appropriate space.

Landfill / Incineration (or other "Final" Disposal) Considerations

Yes	No	
(0)	2	Is a final disposal location available within a reasonable distance from the last point of collection (100 miles in one direction)?
(0)	1	Does this final disposal location provide reasonable rates for disposal?
3	(0)	Does my governmental entity have the resources to support such a venture?
1	(0)	Does my governmental entity have the desire to maintain total control of disposal of municipal wastes generated by our citizens?
0	(2)	Are the citizens of this sub-area served by an entity that provides its own disposal services currently (a private company who prefers to use their own landfills)?
3	(0)	Is there a true need for this? NOTE: There is rarely a need for a governmental entity that does not already operate a "final" disposal location to begin operating one. Permitting and construction costs typically far exceed the costs related with other viable options like transfer stations.

Total Points 2

Citizens Collection Station Considerations

Yes	No	
(3)	0	Is there an illegal dumping problem in the sub-area?
(0)	2	Are the residents and businesses in this sub-area offered collection services, and therefore would not have a need for such a center?
0	(1)	Does the collection service offer heavy trash services, such that there would never be a need for a collection station?
0	(2)	Is there already a location where citizens can dispose their waste (such as a landfill or transfer station) within 10 miles?
(3)	0	Would citizens use the citizens collection station?

Total Points 9

Transfer Station Considerations

Yes	No	
2	(0)	Is my existing system paying too much for transportation and disposal of solid waste because the "final" disposal location is a long distance (greater than 25 miles in each direction)?
(1)	0	Have my existing collection needs exceeded the existing collection abilities?
1	(0)	Are there other entities in the sub-areas that currently use private services that would be interested in partnering to decrease transportation costs?
1	(0)	Is there a private company that would be interested in owning and operating a transfer station in my area?
0	(3)	Would the citizens of my area oppose a transfer station?
(4)	0	Are there customers (CCS locations) that will bring waste to the transfer station?

Total Points 8

Recycling Center Considerations

Yes	No	
(1)	0	Is there the desire for recycling services in my area?
(0)	1	Is there an existing private recycling program in my area?
(1)	0	Would recycling services be used by the citizens in this area?
(5)	0	Is there an available means of reuse for these recyclables and a company who would be willing to take them?
(2)	0	Are the resources available to support a recycling program?

Total Points 9

Residential Collection Services

Yes	No	
(1)	0	Is the population density such that individual disposal of waste is a problem?
0	(2)	Are residents willing to contract for disposal of their own waste, or is it being illegally disposed of?
(0)	2	Are private services available?
0	(1)	Are residents happy with the current services?
(2)	0	Is residential waste currently being illegally dumped?
(2)	0	Would residents be willing to pay a fee to fund residential collection services?

Total Points 8

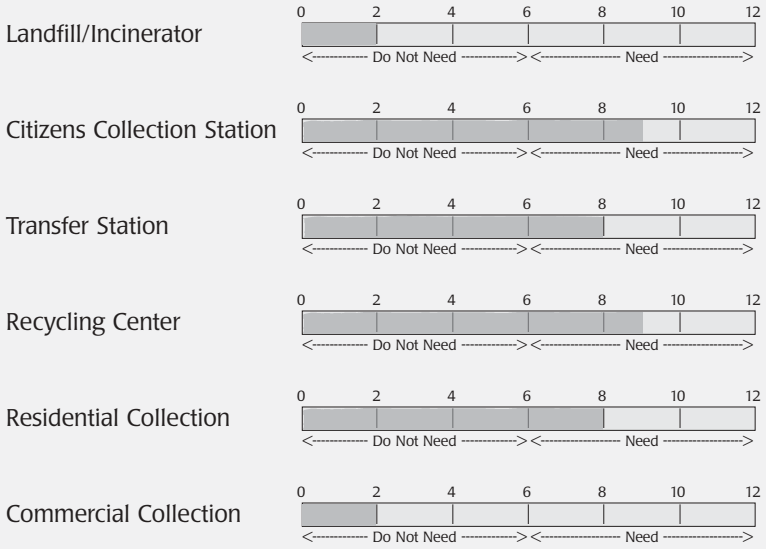
Commercial Collection Services

Yes	No		
(1)	0	Is the commercial density such that businesses are not able to adequately dispose of their own waste?
(0)	2	Are businesses willing to contract for disposal of their own waste?
(1)	0	Is commercial waste being illegally dumped?
(0)	2	Are private services available for commercial collection?
(0)	1	Are commercial collection customers happy with their existing service?

Total Points 2

Needs Of Each Sub-Area

Sub-Area	Landfill/ Incinerator	Citizens Collection Station	Transfer Station	Recycling Center	Residential Collection	Commercial Collection
Total Points from Questions	2	9	8	9	8	2



System Evaluation - Infrastructure Needs

Sub-Area 6 & 7

This worksheet will assist in evaluating the needs of each sub-area (a separate Worksheet 4 is provided for each of the possible ten sub-areas). Point values are assigned to answers for each question on the worksheet. Summing these values allows the user to quantitatively evaluate solid waste needs. More detailed instructions can be found in Section IV: Solid Waste Infrastructure.

To determine the needs of each area, several things must be considered for each type of infrastructure. Circle the appropriate answer for each evaluation question below. After answering all questions, total the scores associated with each answer and place them in the appropriate space.

Landfill / Incineration (or other "Final" Disposal) Considerations

Yes	No	
(0)	2	Is a final disposal location available within a reasonable distance from the last point of collection (100 miles in one direction)?
(0)	1	Does this final disposal location provide reasonable rates for disposal?
3	(0)	Does my governmental entity have the resources to support such a venture?
1	(0)	Does my governmental entity have the desire to maintain total control of disposal of municipal wastes generated by our citizens?
(0)	2	Are the citizens of this sub-area served by an entity that provides its own disposal services currently (a private company who prefers to use their own landfills)?
3	(0)	Is there a true need for this? NOTE: There is rarely a need for a governmental entity that does not already operate a "final" disposal location to begin operating one. Permitting and construction costs typically far exceed the costs related with other viable options like transfer stations.

Total Points 0

Citizens Collection Station Considerations

Yes	No	
(3)	0	Is there an illegal dumping problem in the sub-area?
(0)	2	Are the residents and businesses in this sub-area offered collection services, and therefore would not have a need for such a center?
0	(1)	Does the collection service offer heavy trash services, such that there would never be a need for a collection station?
(0)	2	Is there already a location where citizens can dispose their waste (such as a landfill or transfer station) within 10 miles?
(3)	0	Would citizens use the citizens collection station?

Total Points 7

Transfer Station Considerations

Yes	No	
2	(0)	Is my existing system paying too much for transportation and disposal of solid waste because the "final" disposal location is a long distance (greater than 25 miles in each direction)?
1	(0)	Have my existing collection needs exceeded the existing collection abilities?
1	(0)	Are there other entities in the sub-areas that currently use private services that would be interested in partnering to decrease transportation costs?
1	(0)	Is there a private company that would be interested in owning and operating a transfer station in my area?
0	(3)	Would the citizens of my area oppose a transfer station?
(4)	0	Are there customers (CCS locations) that will bring waste to the transfer station?

Total Points 7

Recycling Center Considerations

Yes	No	
(1)	0	Is there the desire for recycling services in my area?
0	(1)	Is there an existing private recycling program in my area?
(1)	0	Would recycling services be used by the citizens in this area?
5	(0)	Is there an available means of reuse for these recyclables and a company who would be willing to take them?
2	(0)	Are the resources available to support a recycling program?

Total Points 3

Residential Collection Services

Yes	No	
1	(0)	Is the population density such that individual disposal of waste is a problem?
(0)	2	Are residents willing to contract for disposal of their own waste, or is it being illegally disposed of?
(0)	2	Are private services available?
(0)	1	Are residents happy with the current services?
(2)	0	Is residential waste currently being illegally dumped?
(2)	0	Would residents be willing to pay a fee to fund residential collection services?

Total Points 4

Worksheet 4

Commercial Collection Services

Yes No

1 (0) Is the commercial density such that businesses are not able to adequately dispose of their own waste?

(0) 2 Are businesses willing to contract for disposal of their own waste?

1 (0) Is commercial waste being illegally dumped?

(0) 2 Are private services available for commercial collection?

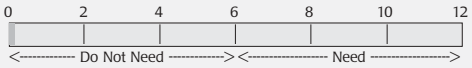
(0) 1 Are commercial collection customers happy with their existing service?

Total Points 0

Needs Of Each Sub-Area

Sub-Area	Landfill/ Incinerator	Citizens Collection Station	Transfer Station	Recycling Center	Residential Collection	Commercial Collection
Total Points from Questions	0	7	7	3	4	0

Landfill/Incinerator



System Evaluation - Infrastructure Needs

Sub-Area 8, 9 & 10

This worksheet will assist in evaluating the needs of each sub-area (a separate Worksheet 4 is provided for each of the possible ten sub-areas). Point values are assigned to answers for each question on the worksheet. Summing these values allows the user to quantitatively evaluate solid waste needs. More detailed instructions can be found in Section IV: Solid Waste Infrastructure.

To determine the needs of each area, several things must be considered for each type of infrastructure. Circle the appropriate answer for each evaluation question below. After answering all questions, total the scores associated with each answer and place them in the appropriate space.

Landfill / Incineration (or other "Final" Disposal) Considerations

Yes	No	
(0)	2	Is a final disposal location available within a reasonable distance from the last point of collection (100 miles in one direction)?
(0)	1	Does this final disposal location provide reasonable rates for disposal?
3	(0)	Does my governmental entity have the resources to support such a venture?
(1)	0	Does my governmental entity have the desire to maintain total control of disposal of municipal wastes generated by our citizens?
(0)	2	Are the citizens of this sub-area served by an entity that provides its own disposal services currently (a private company who prefers to use their own landfills)?
3	(0)	Is there a true need for this? NOTE: There is rarely a need for a governmental entity that does not already operate a "final" disposal location to begin operating one. Permitting and construction costs typically far exceed the costs related with other viable options like transfer stations.

Total Points 1

Citizens Collection Station Considerations

Yes	No	
(3)	0	Is there an illegal dumping problem in the sub-area?
(0)	2	Are the residents and businesses in this sub-area offered collection services, and therefore would not have a need for such a center?
0	(1)	Does the collection service offer heavy trash services, such that there would never be a need for a collection station?
(0)	2	Is there already a location where citizens can dispose their waste (such as a landfill or transfer station) within 10 miles?
3	(0)	Would citizens use the citizens collection station?

Total Points 4

Transfer Station Considerations

Yes	No	
2	(0)	Is my existing system paying too much for transportation and disposal of solid waste because the "final" disposal location is a long distance (greater than 25 miles in each direction)?
1	(0)	Have my existing collection needs exceeded the existing collection abilities?
1	(0)	Are there other entities in the sub-areas that currently use private services that would be interested in partnering to decrease transportation costs?
1	(0)	Is there a private company that would be interested in owning and operating a transfer station in my area?
0	(3)	Would the citizens of my area oppose a transfer station?
4	(0)	Are there customers (CCS locations) that will bring waste to the transfer station?

Total Points 3

Recycling Center Considerations

Yes	No	
(1)	0	Is there the desire for recycling services in my area?
(0)	1	Is there an existing private recycling program in my area?
1	(0)	Would recycling services be used by the citizens in this area?
5	(0)	Is there an available means of reuse for these recyclables and a company who would be willing to take them?
2	(0)	Are the resources available to support a recycling program?

Total Points 1

Residential Collection Services

Yes	No	
(1)	0	Is the population density such that individual disposal of waste is a problem?
(0)	2	Are residents willing to contract for disposal of their own waste, or is it being illegally disposed of?
(0)	2	Are private services available?
(0)	1	Are residents happy with the current services?
(2)	0	Is residential waste currently being illegally dumped?
2	(0)	Would residents be willing to pay a fee to fund residential collection services?

Total Points 3

Worksheet 4

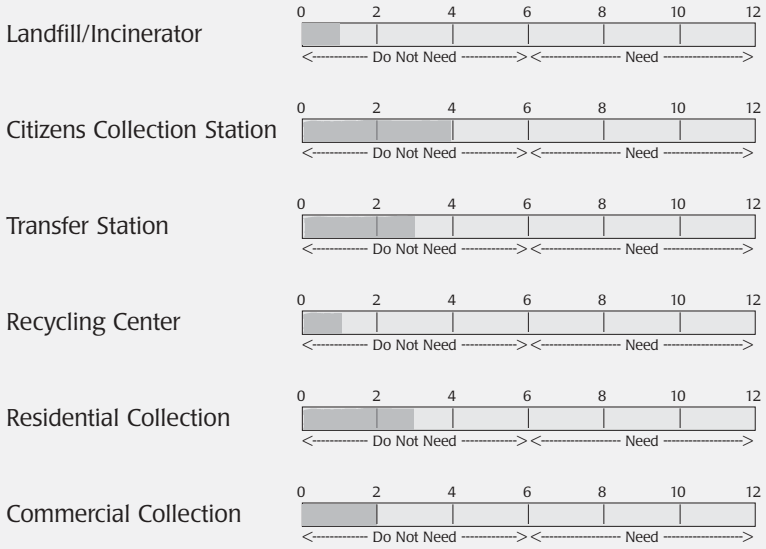
Commercial Collection Services

Yes	No	
(1)	0	Is the commercial density such that businesses are not able to adequately dispose of their own waste?
(0)	2	Are businesses willing to contract for disposal of their own waste?
(1)	0	Is commercial waste being illegally dumped?
(0)	2	Are private services available for commercial collection?
(0)	1	Are commercial collection customers happy with their existing service?

Total Points 2

Needs Of Each Sub-Area

Sub-Area	Landfill/ Incinerator	Citizens Collection Station	Transfer Station	Recycling Center	Residential Collection	Commercial Collection
Total Points from Questions	1	4	3	1	3	2



Existing Solid Waste System - Infrastructure

This worksheet assists the user in delineating the existing solid waste system. An easy to read chart will demonstrate the solid waste infrastructure present in each sub-area. The worksheet also provides an initial idea of the current costs for existing solid waste services in the sub-area.

Outline the population sub-areas determined on Worksheet 1 on a map of the total service area. Using colored pencils, locate each category of the following solid waste infrastructure pieces in a different color. Some items will be drawn as point locations, while others will be shaded areas.

	Item	Suggested Color	
1	Landfill / Incinerator	Blue	Security Landfill(WMX)
1	Citizens Collection Station	Red	Type IV @ PCT 3
1	Transfer Station	Green	HARDY ROAD(Republic)
4	Recycling Center	Purple	Conroe(BFI) WOODLANDS(WMI) PCT 3, PCT 4
	Residential Collection	Yellow	} All of County
	Commercial Collection	Orange	

Once the services have been identified, determine which sub-areas USE this service. Place an X in the box below each item that corresponds with a sub-area using that service.

Worksheet 5

Services Provided To Each Sub-Area

Sub-Area	Landfill/ Incinerator	Citizens Collection Station	Transfer Station	Recycling Center	Residential Collection	Commercial Collection
1	x $46.29			x by PCT 4	x $57.14	x N/A
2	x $46.29		x $51.43	x by PCT 4	x $57.14	x N/A
3	x $46.29	x by PCT 3	x $51.43	by WCSC	x $45.71	x N/A
4	x $46.29		x $51.43		x $57.14	x N/A
5	x $46.29				x $57.14	x N/A
6	x $46.29				x $68.57	x N/A
7	x $46.29				x $68.57	x N/A
8	x $46.29				x $68.57	x N/A
9	x $46.29				x $57.14	x N/A
10	x $46.29			x by BFI	x $35.25	x N/A

Now determine the rates being paid by citizens for each of these services. Rates may vary by sub-area. Place the cost-per-capita of each service being provided in the chart above. Cost-per-capita is simply the total annual cost spent on a service (including capital and operations and maintenance) divided by the total number of people offered that service. If a service spans several sub-areas, determine the cost-per-capita over the entire coverage area.

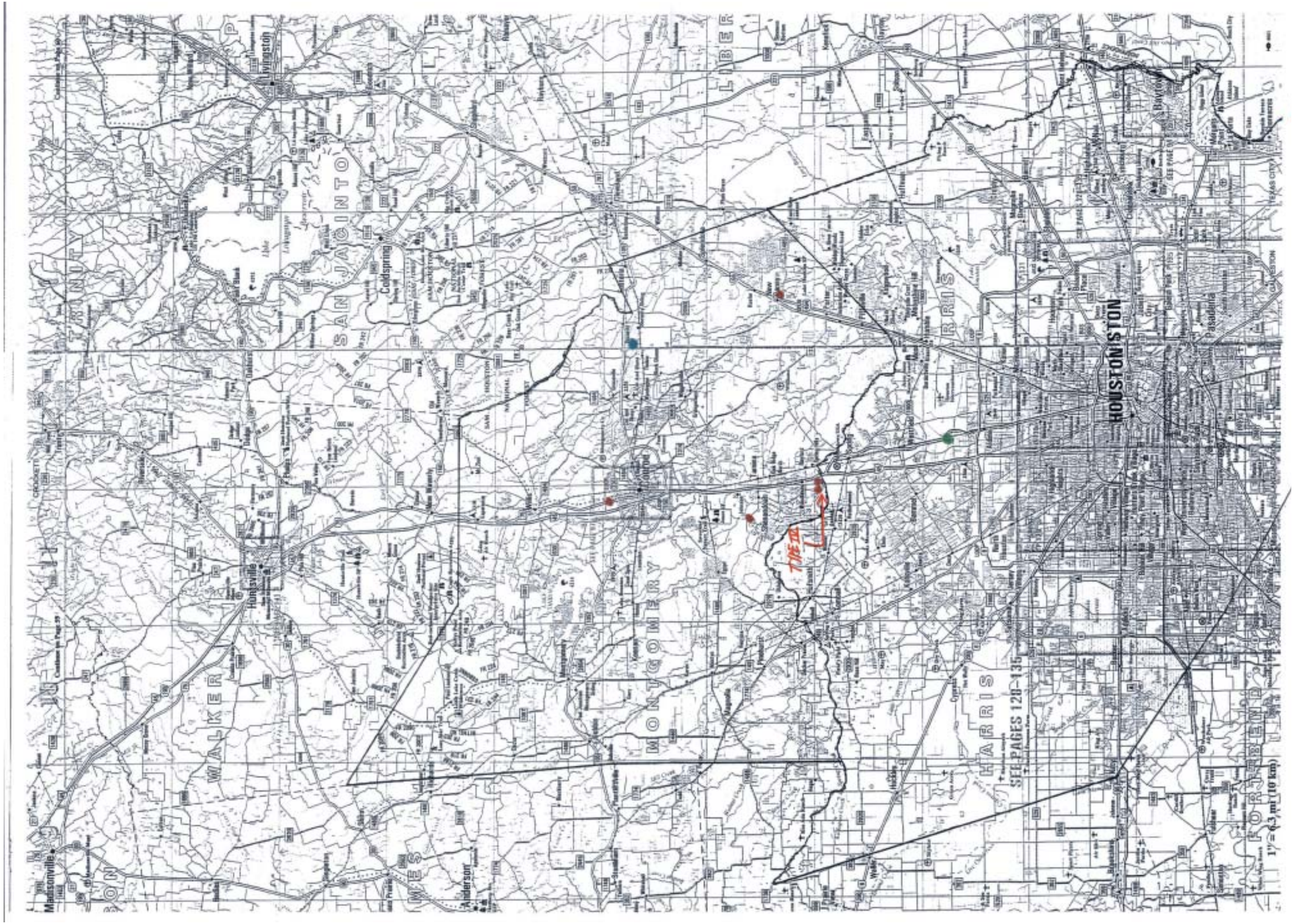

TRINITY
SAN JACINTO
LIBERTY
HARRIS
MONTGOMERY
WALKER
MADISON
Livingston
Coldspring
Huntsville
Madisonville
Anderson
HOUSTONISTON
Pasadena
Baytown
TEXAS CITY
GALVESTON
SEE PAGES 128-135
1" = 6.3 mi (10 km)

Exhibit 13

Worksheet 6

Additional Services Needed

This worksheet provides a synopsis of what additional solid waste services are needed in each sub-area. Although something may be needed in several sub-areas, it may not need to be constructed in each. For example, one transfer station could serve an entire service area, and meet the needs of all sub-areas.

Compare Worksheets 4 (Needs) and 5 (Existing) to determine what is needed, but not existing in each sub-area. Place an X in the box below each item that corresponds with the sub-area needing that additional item.

Additional Services Needed In Each Sub-Area

Sub-Area	Landfill/ Incinerator	Citizens Collection Station	Transfer Station	Recycling Center	Residential Collection	Commercial Collection
1		X	X		X	
2		X	X		X	
3		X	X			X
4						
5		X	X		X	
6		X	X			
7		X	X			
8						
9						
10						

1992 CENSUS TRACTS

H-GAC REGION

MONTGOMERY COUNTY

LEGEND

Tracts Boundary

County Line

(5,280) *Population*

HGAC

Prepared by
Houston-Galveston Area Council
August 1999

CCS
Transfer Station
Residential Collection
Commercial Collection

902.04 (7,172)
902.05 (4,347)
902.06 (5,020)
902.13 (5,783)
902.23 (2,273)
902.37 (5,702)
902.47 (8,020)
906.02 (5,150)
906.21 (2,446)
906.23 (2,234)
906.31 (2,734)

Walker County
Grimes County
San Jacinto County
Liberty County
Waller County
Harris County
Harris County

912.01 (1,316) 8
912.02 (3,673)
911.01 (5,885)
911.02 (7,240) 9
904.00 (2,720)
906.11 (2,248)
910.10 (1,885)
910.20 (5,063) 5
905.00 (6,192) 7
909.00 (4,788)
908.02 (2,665) 1
907.02 (4,188)
908.01 (4,418)
903.11 (3,298) 6
903.21 (4,554)
902.17 (5,587) 3
902.01 4
908.03 (9,109)
903.02 (9,300)
901.01 (2,720)
902.02 (3,670) 2
901.03 (4,986)
901.12 (5,005)
901.22 (2,644)

The maps and data presented herein are intended for general reference only. The source of information is the U.S. Department of Commerce, Bureau of Census. The Houston-Galveston Area Council makes no claim as to its accuracy and neither assumes nor will accept liability for its use.

Exhibit 15

System Evaluation - Costs

This worksheet sums the existing solid waste expenditures by category so that the cost-per-capita of each service can be calculated, as well as a total service area cost-per-capita. These categorized figures will be used when evaluating the impact of system enhancements on the total cost and total cost-per-capita.

The accuracy of the data collected for this worksheet will determine the accuracy of the final results. Begin by researching what is currently being spent on solid waste services in the total service area. A simple analysis would only include the amount being spent only on services provided by the local government. A very detailed analysis would include the amount being spent by the local government and the citizens. The extent of the analysis performed is at the discretion of the person performing the analysis.

Place the total annual cost of each service provided and the number of people this service is offered to on Lines 1 through 9 of Worksheet 7. Guidelines for each category are shown below. Once the cost and the population have been determined, the cost-per-capita can be calculated by simply dividing the cost by the population. Place the cost-per-capita for each service offered on the appropriate line.

Line 1: **Disposal Cost** - The amount spent on landfilling, incinerating, or otherwise disposing of waste. This should include the tipping fee, cost of transportation to the disposal facility, and any personnel or administrative costs associated with disposal activities.

Line 2: **Recycling Cost** - This number should include the cost of personnel associated with recycling activities, cost of recycling materials, operations and maintenance associated with recycling, collection of recyclable materials, etc.

Line 3: **Residential Collection Cost** - This number should include all costs involved with collection of residential waste by existing means. Include items such as personnel, administrative, billing, transportation, maintenance, fuel costs, etc.

Line 4: **Commercial Collection Cost** - This number should include all costs involved with collection of commercial waste by existing means. Include items such as personnel, administrative, billing, transportation, maintenance, fuel costs, etc.

Line 5: **Illegal Dumping** - This number should include costs involved in cleanups of illegal dump sites, additional personnel needed to patrol for illegal dumping, litigation costs involved in prosecuting illegal dumping offenders, administrative costs of processing paperwork, additional mosquito control required due to presence of sites, etc. An amount should also be specified to quantify the amount of lost tax revenue due to the blighted appearance of the areas with illegal dumping problems. A recent H-GAC study found that illegal dumping in rural areas costs $2 to $3 per capita per year. A source for determining this number is H-GAC's illegal dumping workbook, which can be requested from Cheryl Mergo at H-GAC.

Line 6: **Solid Waste Education** - Include all educational costs related to solid waste activities, such as illegal dumping, recycling, landfilling, composting, promotion of facilities and services, incineration, etc.

Line 7: **Administrative Costs** - Many municipal organizations require that an amount be paid into the general fund to cover all general governmental administrative expenses. Estimate that amount here.

Line 8: **General Operations Costs** - This should include operating costs not covered in any of the above items. Examples of items to include are supplies, fuel for vehicles, benefit expenses for employees, permitting fees, professional services required to operate, etc.

Line 9: **Maintenance Costs** - This should include costs to maintain equipment and facilities. Include items such as landscaping, lawn care, required service on equipment, etc.

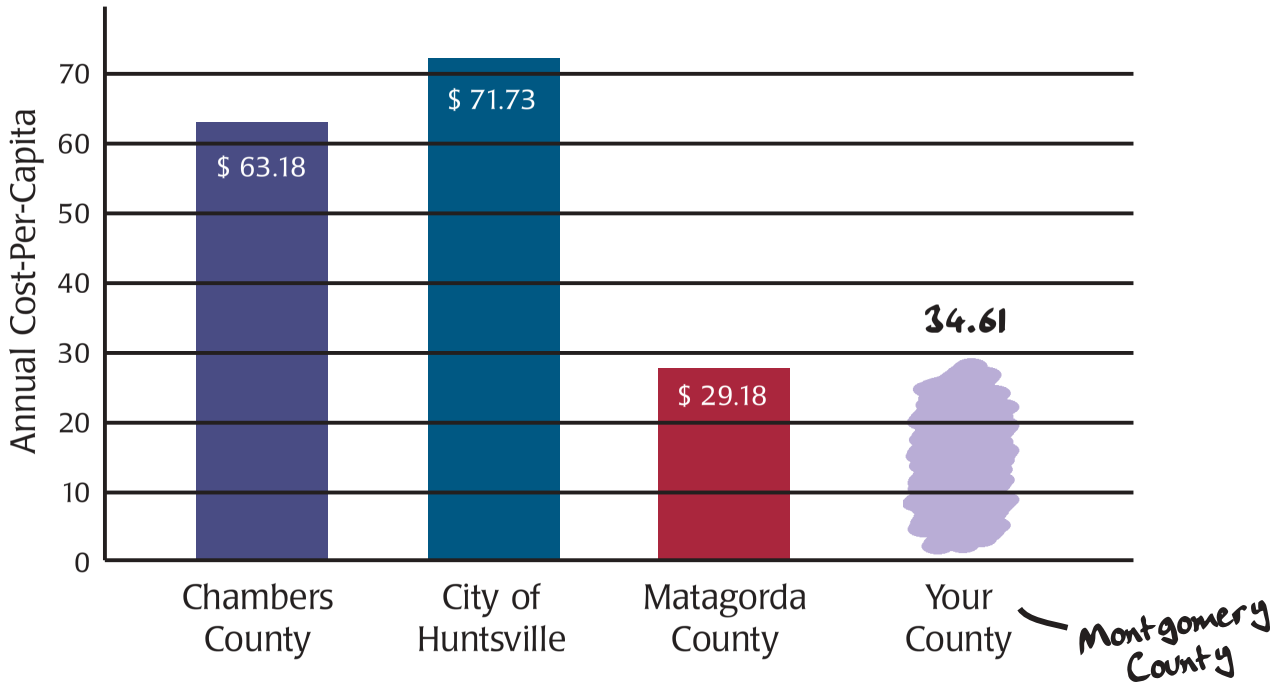
Once the cost-per-capita of each of these items has been determined, sum the total existing costs shown in lines 1 through 9 and place that number on line 10. Determine the total population currently being served by the total solid waste system and place this number on line 11. Calculate the total service cost-per-capita by dividing the total cost (line 10) by the total population (line 11). Place the total service cost-per-capita on line 12.

The cost-per-capita shown in line 12 probably won't be equal to the total of individual cost-per-capita because individual cost-per-capita calculations only consider the population served by that individual service. However, the total system cost-per-capita assumes that all citizens have access to all services.

Existing Solid Waste Costs - Annually

Perform all calculations using annual data.

		Cost	Population	Cost-Per-Capita
Line 1	Disposal Cost	$1,518,560	32,805	$ 46.29
Line 2	Recycling Cost	-	-	-
Line 3	Residential Collection Cost	$ 4,923,084	92,281	$ 47.93
Line 4	Commercial Collection Cost	-	-	-
Line 5	Illegal Dumping	$ 364,402	5,711	$ 63.81
Line 6	Solid Waste Education	-	-	-
Line 7	Administrative	-	-	-
Line 8	General Operations	-	-	-
Line 9	Maintenance	-	-	-
Line 10	**Total Existing Cost**	$ 6,306,046		
Line 11	Population of Service Area	182,201		
Line 12	**Total System Cost-Per-Capita**	$ 34.61		



Comparison of Montgomery County Existing Cost-Per-Capita with Case Studies

Exhibit 17

Cost Of Adding A Citizens Collection Station

admin note: Precinct 2 (Sub-Areas 6 & 7)

Capital Costs

	Price Per Unit		No. of Units		Total Cost
Site Preparation					
Land	0	*	1	=	0
Engineering Services	2,000	*	1	=	2,000
Administrative	1,000	*	1	=	1,000
Ramp and Retaining Wall	25,000	*	1	=	25,000
Attendant Building	5,000	*	1	=	5,000
Fencing	10/sq. ft	*	835 sq. ft	=	8,350
Landscaping	500	*	1	=	500
Roadbase Materials					
Crushed Rock	0.175/sq. ft	*	43,560 sq. ft	=	7623
Asphalt	-	*	-	=	-
Concrete	-	*	-	=	-
Signs	50	*	4	=	200
Promotion/Education	325	*	-	=	325
			Total Site Preparation		49,998
Equipment					
Collection Trailers	-	*	-	=	-
Dumpsters or Green Boxes	-	*	-	=	-
Open Top Roll-Off Boxes					
20 Cubic Yards	-	*	-	=	-
30 Cubic Yards	-	*	-	=	-
40 Cubic Yards	3,500	*	2	=	7,000
Closed Top Roll-Off Boxes	5,000	*	1	=	5,000
Stationary Compactor	7,000	*	1	=	7,000
Pickup Trucks	-	*	-	=	-
One Ton Collection Truck	-	*	-	=	-
Roll-Off Truck	75,000	*	1/2	=	37,500
Truck Scale	-	*	-	=	-
Miscellaneous	2,500	*	1	=	2,500
			Total Equipment Cost		59,000

Capital Costs

	Price Per Unit		No. Of Units		Total Cost
Recycling					
Additional Land	-	*	-	=	-
Additional Road Materials					
Crushed Rock	-	*	-	=	-
Asphalt	-	*	-	=	-
Concrete	-	*	-	=	-
Chipper or Shredder	-	*	-	=	-
Partitioned Containers					
26 Cubic Yard, 4 Door	-	*	-	=	-
Trailer Mounted	-	*	-	=	-
Baler	-	*	-	=	-
Hand Scale	-	*	-	=	-
Can Crusher	-	*	-	=	-
Used Oil or Antifreeze Container	-	*	-	=	-

Total Recycling Cost 0

Total Initial Capital Costs 108,998

Annual Depreciation Schedule

Item	Total Cost	Divided By	Useful Life	=	Annual Depreciation Amount
ramp and retaining wall	25,000	/	25	=	1,000
attendant building	5,000	/	25	=	200
fencing	8,350	/	10	=	835
crushed rock	7,623	/	5	=	1,525
roll-off containers	12,000	/	10	=	1,200
stationary compactors	7,000	/	10	=	700
		/		=	
		/		=	
		/		=	
		/		=	
		/		=	
		/		=	

Annual Depreciation Schedule (cont.)

Vehicle Depreciation

103 Loose (C.Y.)	/ divided by	40 Volume of Collection Bin	=	2.6 Required Trips per Day for Disposal
2.6 Trips per Day	* multiplied by	56 Round-Trip Miles per Trip	=	146 Miles per Day
26 Compacted (C.Y.)	/ divided by	40 Volume of Collection Bin	=	0.7 Required Trips per Day for Disposal
0.7 Trips per Day	* multiplied by	56 Round-Trip Miles per Trip	=	39 Miles per Day

Total Miles Per Day = Loose Plus Compacted 185

185 Miles per Day	* multiplied by	365 365 Days per Year	=	67,525 Miles per Year
200,000 200,000 Miles/ Truck Life	/ divided by	67,525 Miles/Year	=	3 Life of Vehicle

37,500 Cost of Vehicle	/ divided by	3 Life of Vehicle	=	12,500 Annual Depreciation Amount

Total Annual Depreciation 17,960

8g

Operating Costs

Labor

attendant (Direct)		2,080 (Annual Hours)	x	$6 (Hourly Wage)	=	12,480
driver (Direct)		1,040 (Annual Hours)	x	$12 (Hourly Wage)	=	12,480
- (Direct)		- (Annual Hours)	x	- (Hourly Wage)	=	-
- (Direct)		- (Annual Hours)	x	- (Hourly Wage)	=	-
- (Direct)		- (Annual Hours)	x	- (Hourly Wage)	=	-
- (Direct)		- (Annual Hours)	x	- (Hourly Wage)	=	-
Indirect Labor Costs	=	24,960 (**Total Direct Cost**)	x	0.3 (**Percent Increase**)	=	7,488
Transportation & Maintenance		48,100 (Total Miles)	x	$1 ($1 per Mile)	=	48,100
Utilities		200 (Average Monthly Expense)	x	12 (12 Months)	=	2,400
Disposal		10,687 tons (Annual Waste Volume)	x	$28/ton (Tipping Fee per Volume)	=	299,236
Recycling						0

Total Operating Cost 382,184

Total Annual Depreciation and Operating Cost 400,144

8h

Operating Costs

Population Of Service Area 26,085

Total Cost-Per-Capita: 400,144 (Total Annual Depreciation and Operating Costs) / divided by 26,085 (Population) = 15.34

Total Capital Investment-Per-Capita: 108,998 (Total Capital Investment) / divided by 26,085 (Population) = 4.18

Total Operating Expense-Per-Capita: 382,184 (Total Operating Expense) / divided by 26,085 (Population) = 14.65

Cost-Per-Ton: 400,144 (Total Annual Depreciation and Operating Costs) / divided by 10,687 (Annual Volume in Tons) = 37.44

Cost Of Adding A Citizens Collection Station

Precinct 3
(Sub-Areas 3, 4, 1/4 of 2)

Capital Costs

	Price Per Unit		No. of Units		Total Cost
Site Preparation					
Land	0	*	1	=	0
Engineering Services	2,000	*	1	=	2,000
Administrative	1,000	*	1	=	1,000
Ramp and Retaining Wall	15,000	*	1	=	15,000
Attendant Building	5,000	*	1	=	5,000
Fencing	10/sq. ft	*	835 sq. ft	=	8,350
Landscaping	500	*	1	=	500
Roadbase Materials					
Crushed Rock	0.175/sq. ft	*	43,560 sq. ft	=	7,623
Asphalt	-	*	-	=	-
Concrete	-	*	-	=	-
Signs	50	*	4	=	200
Promotion/Education	315	*	-	=	315
			Total Site Preparation		49,998
Equipment					
Collection Trailers	-	*	-	=	-
Dumpsters or Green Boxes	-	*	-	=	-
Open Top Roll-Off Boxes					
20 Cubic Yards	-	*	-	=	-
30 Cubic Yards	-	*	-	=	-
40 Cubic Yards	3,500	*	2	=	7,000
Closed Top Roll-Off Boxes	5,000	*	1	=	5,000
Stationary Compactor	7,000	*	1	=	7,000
Pickup Trucks	-	*	-	=	-
One Ton Collection Truck	-	*	-	=	-
Roll-Off Truck	75,000	*	1	=	75,000
Truck Scale	-	*	-	=	-
Miscellaneous	1,500	*	1	=	1,500
			Total Equipment Cost		96,500

Capital Costs

	Price Per Unit		No. Of Units		Total Cost
Recycling					
Additional Land	-	*	-	=	-
Additional Road Materials					
Crushed Rock	-	*		=	
Asphalt	-	*	-	=	-
Concrete	-	*	-	=	-
Chipper or Shredder	-	*	-	=	-
Partitioned Containers					
26 Cubic Yard, 4 Door	-	*	-	=	-
Trailer Mounted	-	*	-	=	-
Baler	-	*	-	=	-
Hand Scale	-	*	-	=	-
Can Crusher	-	*	-	=	-
Used Oil or Antifreeze Container	-	*	-	=	-

Total Recycling Cost 0

Total Initial Capital Costs 146,498

Annual Depreciation Schedule

Item	Total Cost	Divided By	Useful Life	=	Annual Depreciation Amount
ramp and retaining wall	25,000	/	25	=	1,000
attendant building	5,000	/	25	=	200
fencing	8,350	/	10	=	835
crushed rock	7,623	/	5	=	1,525
roll-off containers	12,000	/	10	=	1,200
stationary compactors	7,000	/	10	=	700
		/		=	
		/		=	
		/		=	
		/		=	
		/		=	
		/		=	

Annual Depreciation Schedule (cont.)

Vehicle Depreciation

311	/	40	=	8		
Loose (C.Y.)	divided by	Volume of Collection Bin		Required Trips per Day for Disposal		
8	*	30	=	240		
Trips per Day	multiplied by	Round-Trip Miles per Trip		Miles per Day		
80	/	40	=	2		
Compacted (C.Y.)	divided by	Volume of Collection Bin		Required Trips per Day for Disposal		
2	*	30	=	60		
Trips per Day	multiplied by	Round-Trip Miles per Trip		Miles per Day		

Total Miles Per Day = Loose Plus Compacted 300

300	*	365	=	109,500		
Miles per Day	multiplied by	365 Days per Year		Miles per Year		
200,000	/	109,500	=	1.8		
200,000 Miles/ Truck Life	divided by	Miles/Year		Life of Vehicle		
75,000	/	1.8	=	41,667		
Cost of Vehicle	divided by	Life of Vehicle		Annual Depreciation Amount		

Total Annual Depreciation 47,127

8g

Operating Costs

Labor

attendant (Direct)	2,080 (Annual Hours)	x	$6 (Hourly Wage)	=		12,480
driver (Direct)	2,080 (Annual Hours)	x	$12 (Hourly Wage)	=		24,960
- (Direct)	- (Annual Hours)	x	- (Hourly Wage)	=		-
- (Direct)	- (Annual Hours)	x	- (Hourly Wage)	=		-
- (Direct)	- (Annual Hours)	x	- (Hourly Wage)	=		-
- (Direct)	- (Annual Hours)	x	- (Hourly Wage)	=		-
Indirect Labor Costs	37,440 (**Total Direct Cost**)	**x**	0.3 (**Percent Increase**)	**=**		11,232
Transportation & Maintenance	78,000 (Total Miles)	x	$1 ($1 per Mile)	=		78,000
Utilities	200 (Average Monthly Expense)	x	12 (12 Months)	=		2,400
Disposal	32,428 tons (Annual Waste Volume)	x	$28/ton (Tipping Fee per Volume)	=		907,984
Recycling						0

Total Operating Cost 1,037,056

Total Annual Depreciation and Operating Cost 1,084,183

8h

Operating Costs

Population Of Service Area 55,470

Total Cost-Per-Capita: 1,084,183 (Total Annual Depreciation and Operating Costs) / divided by 55,470 (Population) = 19.55

Total Capital Investment-Per-Capita: 146,498 (Total Capital Investment) / divided by 55,470 (Population) = 2.64

Total Operating Expense-Per-Capita: 1,037,056 (Total Operating Expense) / divided by 55,470 (Population) = 18.70

Cost-Per-Ton: 1,084,183 (Total Annual Depreciation and Operating Costs) / divided by 32,428 (Annual Volume in Tons) = 33.43

Worksheet 8

Cost Of Adding A Citizens Collection Station

PCT. 4 (Sub-Areas 3/4 of 2, 1/2 of 1, 1/3 of 5)

Capital Costs

	Price Per Unit		No. of Units		Total Cost
Site Preparation					
Land	0	*	1	=	0
Engineering Services	2,000	*	1	=	2,000
Administrative	1,000	*	1	=	1,000
Ramp and Retaining Wall	15,000	*	1	=	15,000
Attendant Building	5,000	*	1	=	5,000
Fencing	10/sq. ft	*	835 sq. ft	=	8,500
Landscaping	500	*	1	=	500
Roadbase Materials					
Crushed Rock	0.175/sq. ft	*	43,560 sq. ft	=	7,623
Asphalt	-	*	-	=	-
Concrete	-	*	-	=	-
Signs	50	*	4	=	200
Promotion/Education	315	*	-	=	315
			Total Site Preparation		49,998
Equipment					
Collection Trailers	-	*	-	=	-
Dumpsters or Green Boxes	-	*	-	=	-
Open Top Roll-Off Boxes					
20 Cubic Yards	-	*	-	=	-
30 Cubic Yards	-	*	-	=	-
40 Cubic Yards	3,500	*	2	=	7,000
Closed Top Roll-Off Boxes	5,000	*	1	=	5,000
Stationary Compactor	7,000	*	1	=	7,000
Pickup Trucks	-	*	-	=	-
One Ton Collection Truck	-	*	-	=	-
Roll-Off Truck	75,000	*	1/2	=	37,500
Truck Scale	-	*	-	=	-
Miscellaneous	2,500	*	1	=	2,500
			Total Equipment Cost		59,000

Capital Costs

	Price Per Unit		No. Of Units		Total Cost
Recycling					
Additional Land	-	*	-	=	-
Additional Road Materials					
Crushed Rock	-	*	-	=	-
Asphalt	-	*	-	=	-
Concrete	-	*	-	=	-
Chipper or Shredder	-	*	-	=	-
Partitioned Containers					
26 Cubic Yard, 4 Door	-	*	-	=	-
Trailer Mounted	-	*	-	=	-
Baler	-	*	-	=	-
Hand Scale	-	*	-	=	-
Can Crusher	-	*	-	=	-
Used Oil or Antifreeze Container	-	*	-	=	-

Total Recycling Cost 0

Total Initial Capital Costs 108,998

Annual Depreciation Schedule

Item	Total Cost	Divided By	Useful Life	=	Annual Depreciation Amount
ramp and retaining wall	25,00	/	25	=	1,000
attendant building	5,000	/	25	=	200
fencing	8,350	/	10	=	835
crushed rock	7,623	/	5	=	1,525
roll-off containers	12,000	/	10	=	1,200
stationary compactors	7,000	/	10	=	700
		/		=	
		/		=	
		/		=	
		/		=	
		/		=	
		/		=	

Annual Depreciation Schedule (cont.)

Vehicle Depreciation

99	/	40	=	2.5		
Loose (C.Y.)	divided by	Volume of Collection Bin		Required Trips per Day for Disposal		
2.5	*	30	=	75		
Trips per Day	multiplied by	Round-Trip Miles per Trip		Miles per Day		
26	/	40	=	0.7		
Compacted (C.Y.)	divided by	Volume of Collection Bin		Required Trips per Day for Disposal		
0.7	*	30	=	21		
Trips per Day	multiplied by	Round-Trip Miles per Trip		Miles per Day		

Total Miles Per Day = Loose Plus Compacted 96

96	*	365	=	35,040		
Miles per Day	multiplied by	365 Days per Year		Miles per Year		
200,000	/	35,040	=	5.7		
200,000 Miles/ Truck Life	divided by	Miles/Year		Life of Vehicle		
37,500	/	5.7	=	6,579		
Cost of Vehicle	divided by	Life of Vehicle		Annual Depreciation Amount		

Total Annual Depreciation 12,039

8g

Operating Costs

Labor

attendant (Direct)		2,080 (Annual Hours)	x	$6 (Hourly Wage)	=	12,480
driver (Direct)		1,040 (Annual Hours)	x	$12 (Hourly Wage)	=	12,480
- (Direct)		- (Annual Hours)	x	- (Hourly Wage)	=	-
- (Direct)		- (Annual Hours)	x	- (Hourly Wage)	=	-
- (Direct)		- (Annual Hours)	x	- (Hourly Wage)	=	-
- (Direct)		- (Annual Hours)	x	- (Hourly Wage)	=	-
Indirect Labor Costs	=	24,960 (**Total Direct Cost**)	x	0.3 (**Percent Increase**)	=	7,488

Transportation & Maintenance		24,960 (Total Miles)	x	$1 ($1 per Mile)	=	24,960
Utilities		200 (Average Monthly Expense)	x	12 (12 Months)	=	2,400
Disposal		10,272 tons (Annual Waste Volume)	x	$28/ton (Tipping Fee per Volume)	=	287,616
Recycling						0

Total Operating Cost 347,424

Total Annual Depreciation and Operating Cost 359,463

8h

Operating Costs

Population Of Service Area 29,880

Total Cost-Per-Capita: 359 (Total Annual Depreciation and Operating Costs) / divided by 29,880 (Population) = 12.03

Total Capital Investment-Per-Capita: 108,998 (Total Capital Investment) / divided by 29,880 (Population) = 3.65

Total Operating Expense-Per-Capita: 347,424 (Total Operating Expense) / divided by 29,880 (Population) = 11.63

Cost-Per-Ton: 359 (Total Annual Depreciation and Operating Costs) / divided by 10,271 (Annual Volume in Tons) = 34.99

Proposed Montgomery County CCS Layout

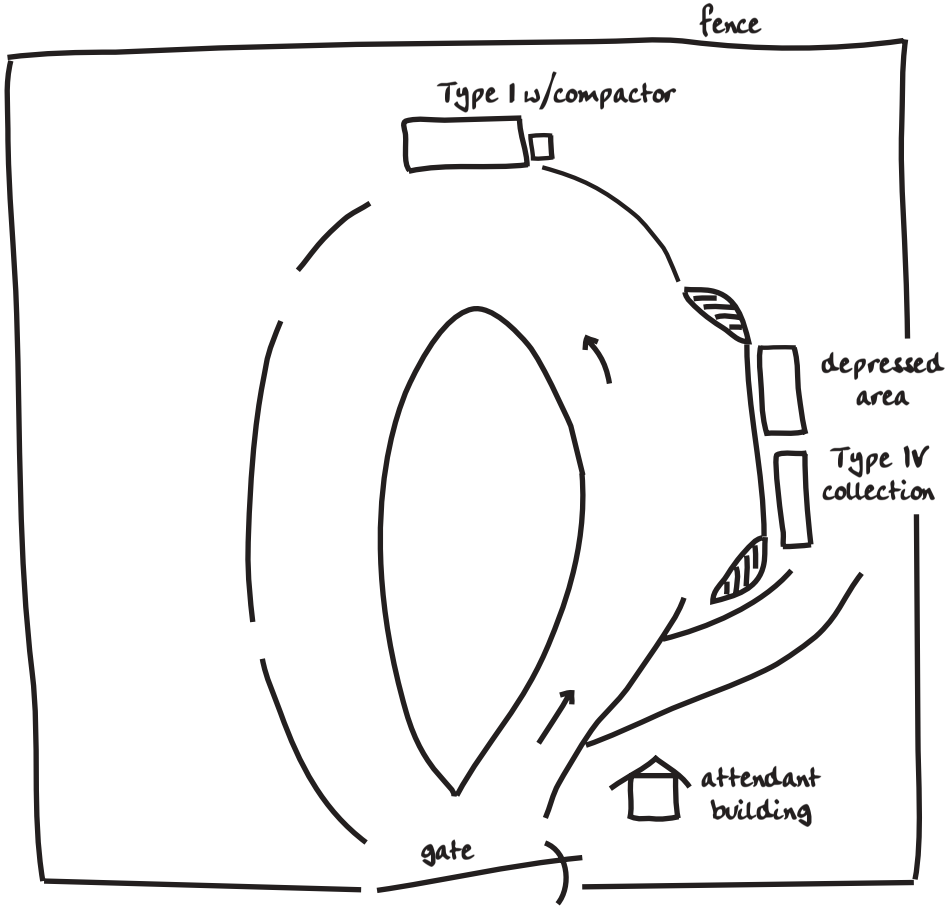


Exhibit 18

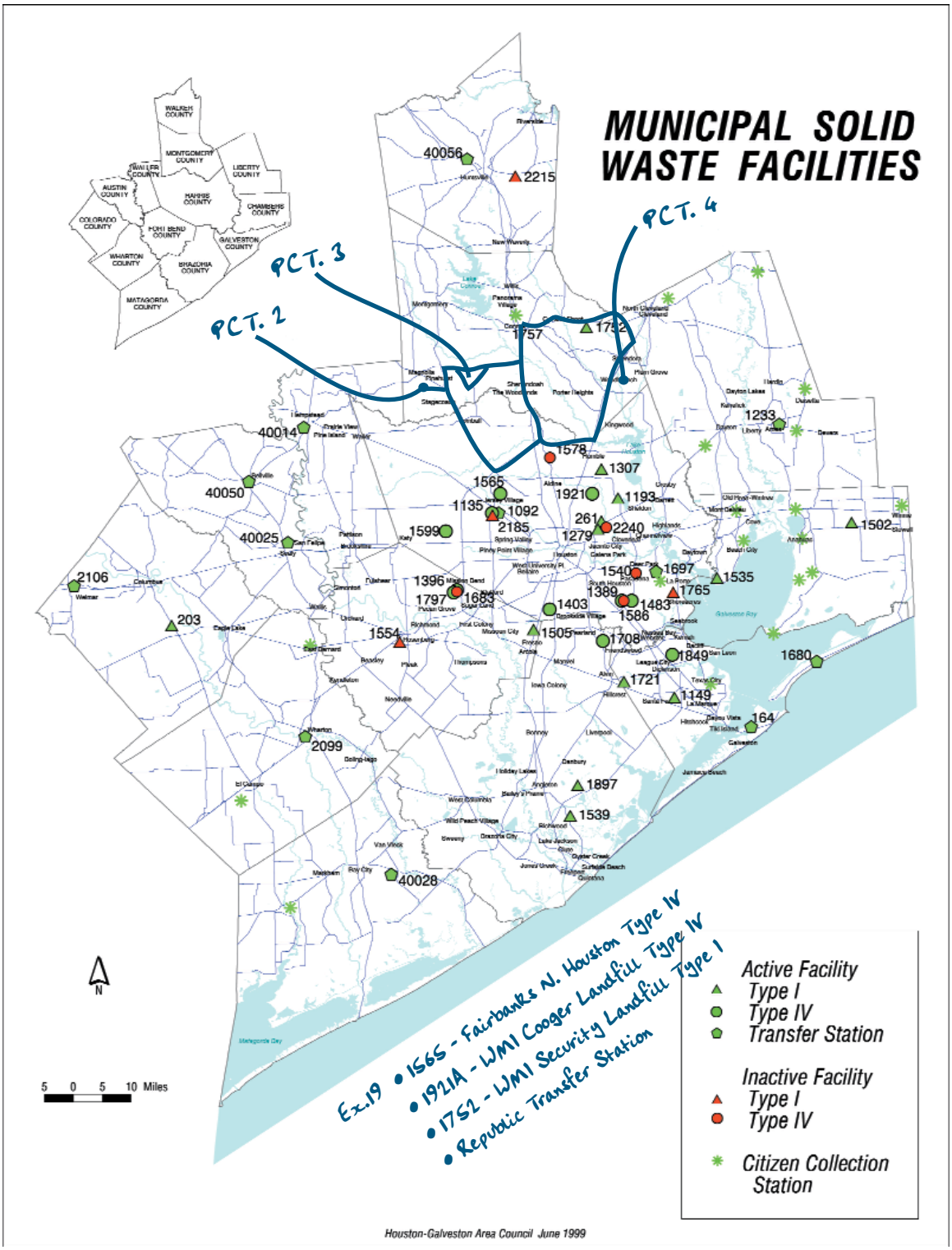

MUNICIPAL SOLID WASTE FACILITIES
PCT. 2
PCT. 3
PCT. 4
WALKER COUNTY
MONTGOMERY COUNTY
WALLER COUNTY
LIBERTY COUNTY
AUSTIN COUNTY
HARRIS COUNTY
CHAMBERS COUNTY
COLORADO COUNTY
FORT BEND COUNTY
GALVESTON COUNTY
WHARTON COUNTY
BRAZORIA COUNTY
MATAGORDA COUNTY
40056
2215
1752
1757
40014
1578
1307
1565
1921
1193
1135
1092
2185
261
2240
1279
40050
40025
1599
1502
1233
2106
1396
1797
1683
1540
1697
1535
1765
1389
1403
1483
1586
203
1554
1505
1708
1849
1680
1721
1149
164
2099
1897
1539
40028
Ex.19 • 1565 - Fairbanks N. Houston Type IV
• 1921A - WMI Cooger Landfill Type IV
• 1752 - WMI Security Landfill Type I
• Republic Transfer Station
Active Facility
Type I
Type IV
Transfer Station
Inactive Facility
Type I
Type IV
Citizen Collection Station
N
5 0 5 10 Miles
Houston-Galveston Area Council June 1999

Exhibit 19

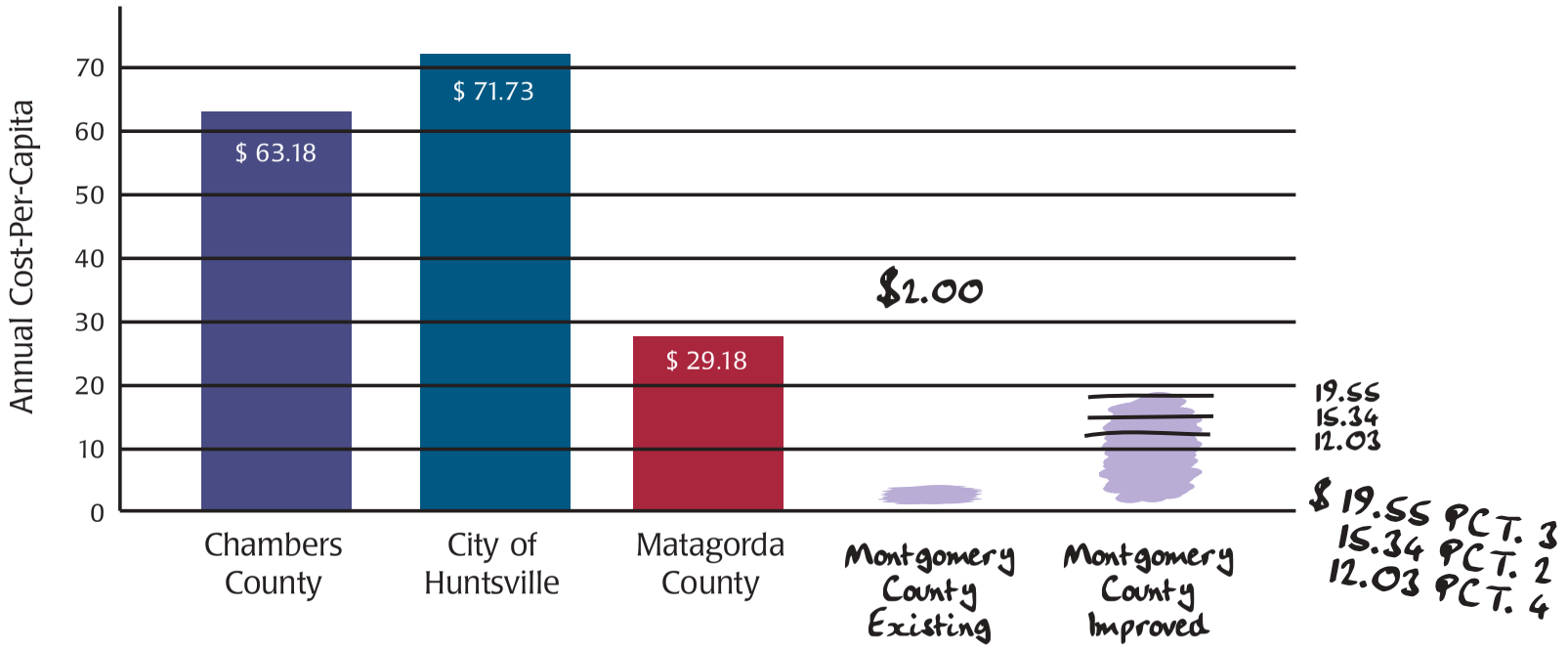
Worksheet 9

Cost Averted With The Addition Of A Citizens Collection Station

This worksheet determines the amount of currently expended funds that would no longer be necessary with the addition of a CCS. Review Worksheet 7 and determine what existing expenditures would be diverted. An example would be the diversion of expenditures on illegal dumping because citizens would now have a convenient and affordable means of disposing of their waste legally.

Total Cost That Could Be Diverted By CCS

Landfill	$707,994
Incinerator	-
Citizens Collection Station	-
Transfer Station	-
Recycling Collection	-
Residential Collection Services	-
Commercial Collection Services	-
Illegal Dumping	$111,434
Total	$819,428
Total Population Serviced By New CCS	111,435
Cost-Per-Capita In Savings	$7.35



Comparison of CCS Improved Montgomery County System with Case Studies

Exhibit 21

Re-Evaluation of Addition of CCS to Montgomery County

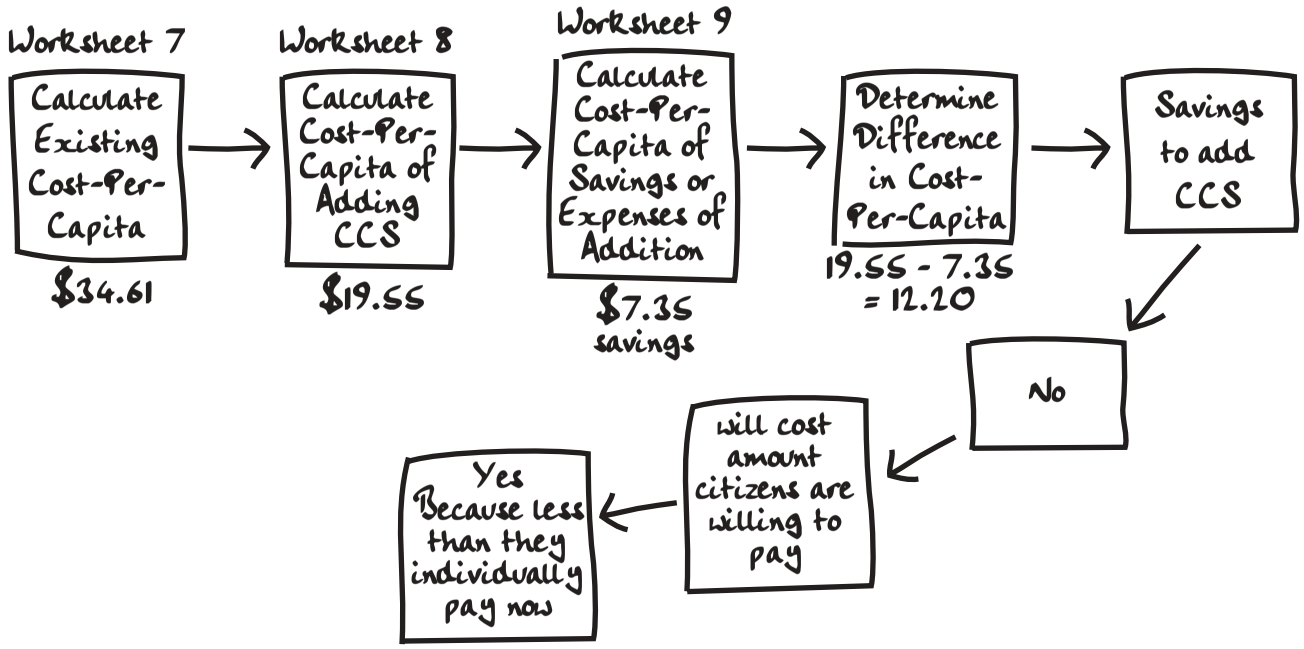


Exhibit 22

Cost Of Adding A Transfer Station

Capital Costs

	Price Per Unit	No. Of Units	Total Cost
Site Preparation			
Land	0	-	0
Engineering Services	15,000/acre	3 acres	45,000
Administrative	5,000	1	5,000
Transfer Station Building	$40/sq. ft.	5,000/sq. ft.	200,000
Concrete Work and Foundations	200,000	1	200,000
Retaining Wall	25,000	1	25,000
Attendant Building	5,000	1	5,000
Fencing	$10/ft.	1,664 feet	16,640
Site Work	15,000/acre	3 acres	45,000
Landscaping	15,00/acre	3 acres	4,500
Roadbase Materials			
Crushed Rock	0.175/sq. ft.	43,560	7,623
Asphalt	1.00/sq. ft.	43,560	43,560
Concrete	-	43,560	-
Signs	50	-	500
Promotion/Education	2,000	10	2,000
		1	
		Sub-Total of Site Preparation	599,823
Contingency (10% of Sub-Total)			59,981
		Total Site Preparation	659,805

Equipment					
Open Top Roll-Off Boxes					
20 Cubic Yards	-	*		=	-
30 Cubic Yards	-	*	-	=	-
40 Cubic Yards	3,500	*	-	=	7,000
Closed Top Roll-Off Boxes	-	*	2	=	-
Stationary Compactor	-	*	-	=	-
Pickup Trucks	-	*	-	=	-
Transfer Truck	90,000	*	-	=	90,000
Trailer for Transfer Truck	60,000	*	1	=	60,000
Roll-Off Truck	-	*	1	=	-
Knuckle Boom	85,000	*	-	=	85,000
Front End Loader	90,000	*	1	=	90,000
Truck Scale	35,000	*	1	=	35,000
Miscellaneous	-	*	1	=	-
			-		
			Total Equipment Cost		367,000

10e

Capital Costs

	Price Per Unit		No. Of Units		Total Cost
Recycling					
Additional Land	-	*	-	=	-
Additional Road Materials					
Crushed Rock	-	*	-	=	-
Asphalt	-	*	-	=	-
Concrete	-	*	-	=	-
Chipper or Shredder	-	*	-	=	-
Partitioned Containers					
26 Cubic Yard, 4 Door	-	*	-	=	-
Trailer Mounted	-	*	-	=	-
Baler	-	*	-	=	-
Hand Scale	-	*	-	=	-
Can Crusher	-	*	-	=	-
Used Oil or Antifreeze Container	-	*	-	=	-

Total Recycling Cost 0

Total Initial Capital Costs 1,026,805

Annual Depreciation Schedule

Item	Total Cost	Divided By	Useful Life	=	Annual Depreciation Amount
transfer station bldg	250,-000	/	25	=	10,000
retaining wall	25,000	/	25	=	1,000
attendant building	5,000	/	25	=	200
fence	16,640	/	10	=	1,664
roll-off containers	7,000	/	10	=	700
crushed rock	7,623	/	5	=	1,525
asphalt	43,560	/	10	=	4,356
Knuckle boom	85,000	/	20	=	4,250
front-end loader	90,000	/	20	=	4,500
trailer for transfer truck	60,000	/	10	=	6,000
truck scale	35,000	/	15	=	2,333
-	-	/	-	=	-
-	-	/	-	=	-
-	-	/	-	=	-
-	-	/	-	=	-

Annual Depreciation Schedule

Vehicle Depreciation

340	/	105	=	3.2		
Volume (C.Y.)	divided by	Volume of Collection Bin		Required Trips per Day for Disposal		
3.2	*	20	=	64		
Trips per Day	multiplied by	Round-Trip Miles per Trip		Miles per Day		
64	/	365	=	23,360		
Miles per Day	multiplied by	365 Days per Year		Miles per Year		
200,000	/	23,360	=	8.6		
200,000 Miles/ Truck Life	divided by	Miles/Year		Life of Vehicle		
		90,000	/	8.6	=	10,465
		Cost of Vehicle	divided by	Life of Vehicle		Annual Depreciation Amount

Total Annual Depreciation 46,993

10g

Operating Costs

Labor

front-end loader (Direct)	2,080 Annual Hours	x	$8 Hourly Wage	=	16,640
transfer driver (Direct)	2,080 Annual Hours	x	$12 Hourly Wage	=	24,960
attendant (Direct)	2,080 Annual Hours	x	$6 Hourly Wage	=	12,480
laborer (Direct)	2,080 Annual Hours	x	$6 Hourly Wage	=	12,480
- (Direct)	- Annual Hours	x	- Hourly Wage	=	-
indirect Labor Costs =	66,560 **Total Direct Cost**	**x**	$6.3 **Percent Increase**	**=**	19,968
Transportation And Maintenance	23,360 Total Miles	x	$1 $1 per Mile	=	23,360
Utilities	1,500 Average Monthly Expense	x	12 12 Months	=	18,000
Disposal	124,100 tons Annual Waste Volume	x	$25/ton Tipping Fee per Volume	=	3,102,500
Recycling					-

Total Operating Cost 3,230,388

Total Annual Depreciation and Operating Cost 3,277,381

10h

Operating Costs

Population Of Service Area 127,254

Total Cost-Per-Capita: 3,277,381 (Total Annual Depreciation and Operating Cost) / divided by 127,254 (Population) = 25.75

Total Capital Investment-Per-Capita: 1,026,805 (Total Capital Investment) / divided by 127,254 (Population) = 8.07

Total Operating Expense-Per-Capita: 3,230,388 (Total Operating Expense) / divided by 127,254 (Population) = 25.39

Cost-Per-Ton: 3,277,381 (Total Annual Depreciation and Operating Costs) / divided by 124,100 (Annual Volume in Tons) = 26.41

Transportation Facilities

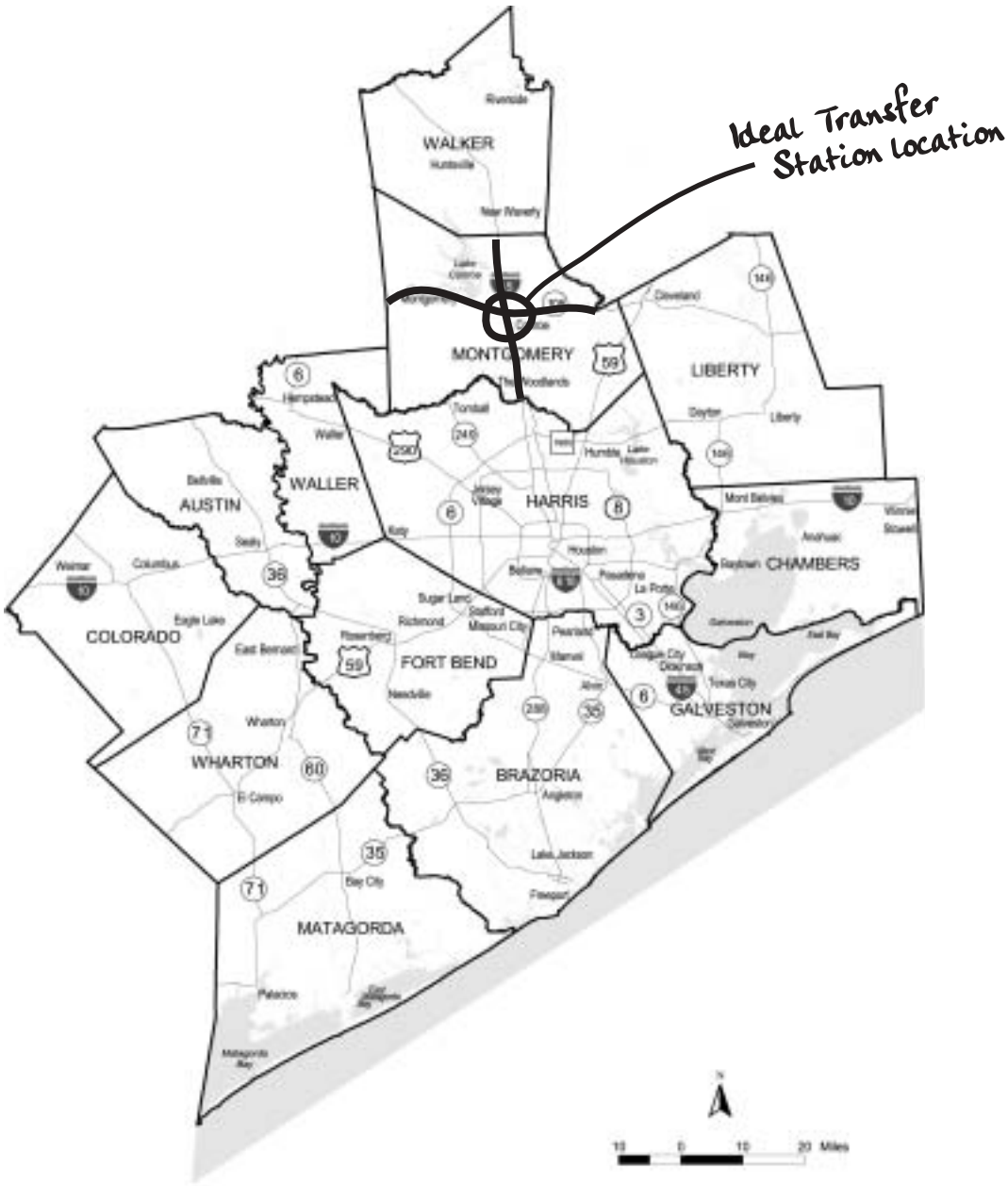


Exhibit 23

Proposed Montgomery County Transfer Station

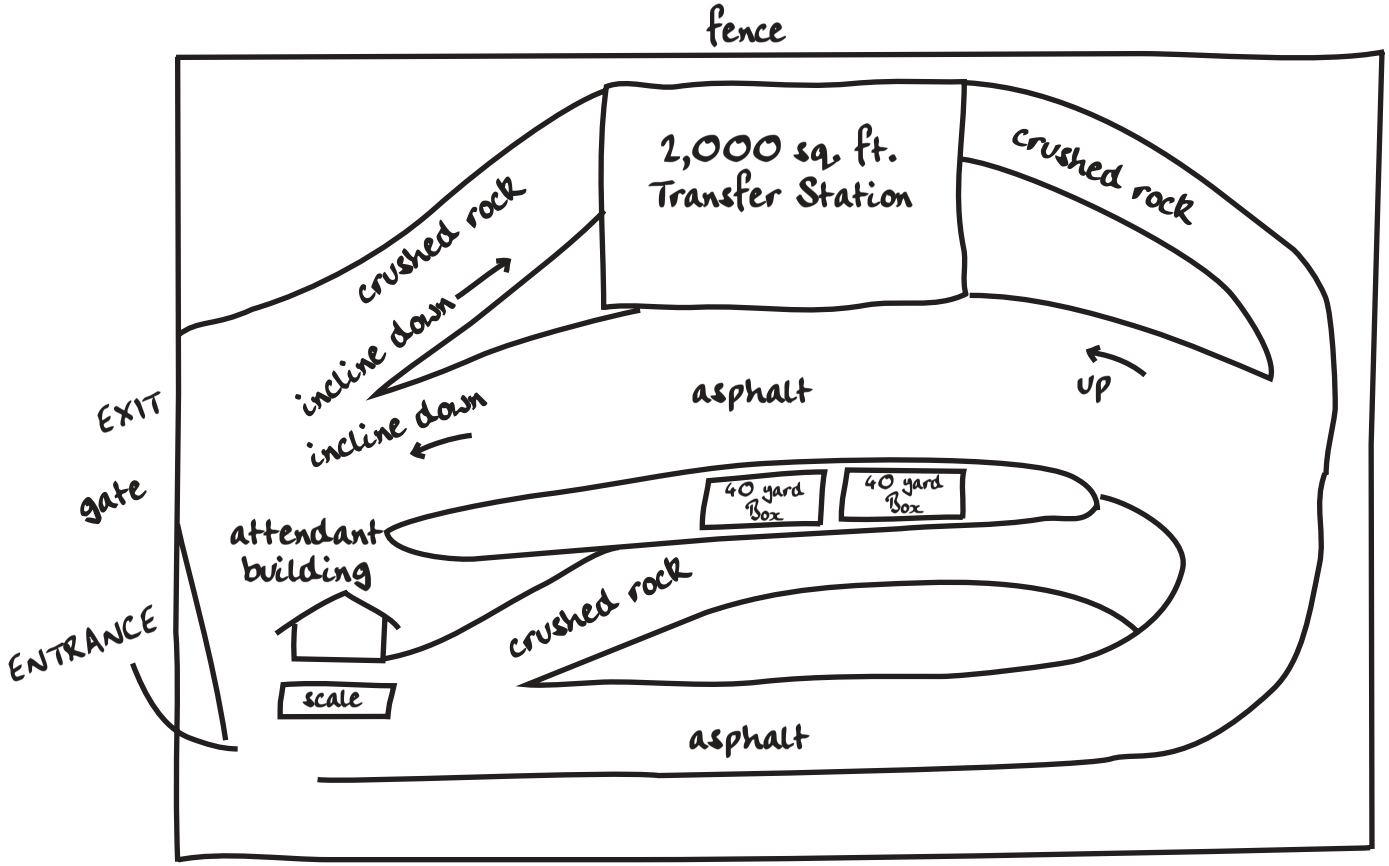


Exhibit 24a

Exhibit 24b

Montgomery County Transfer Station

Exhibit 24b

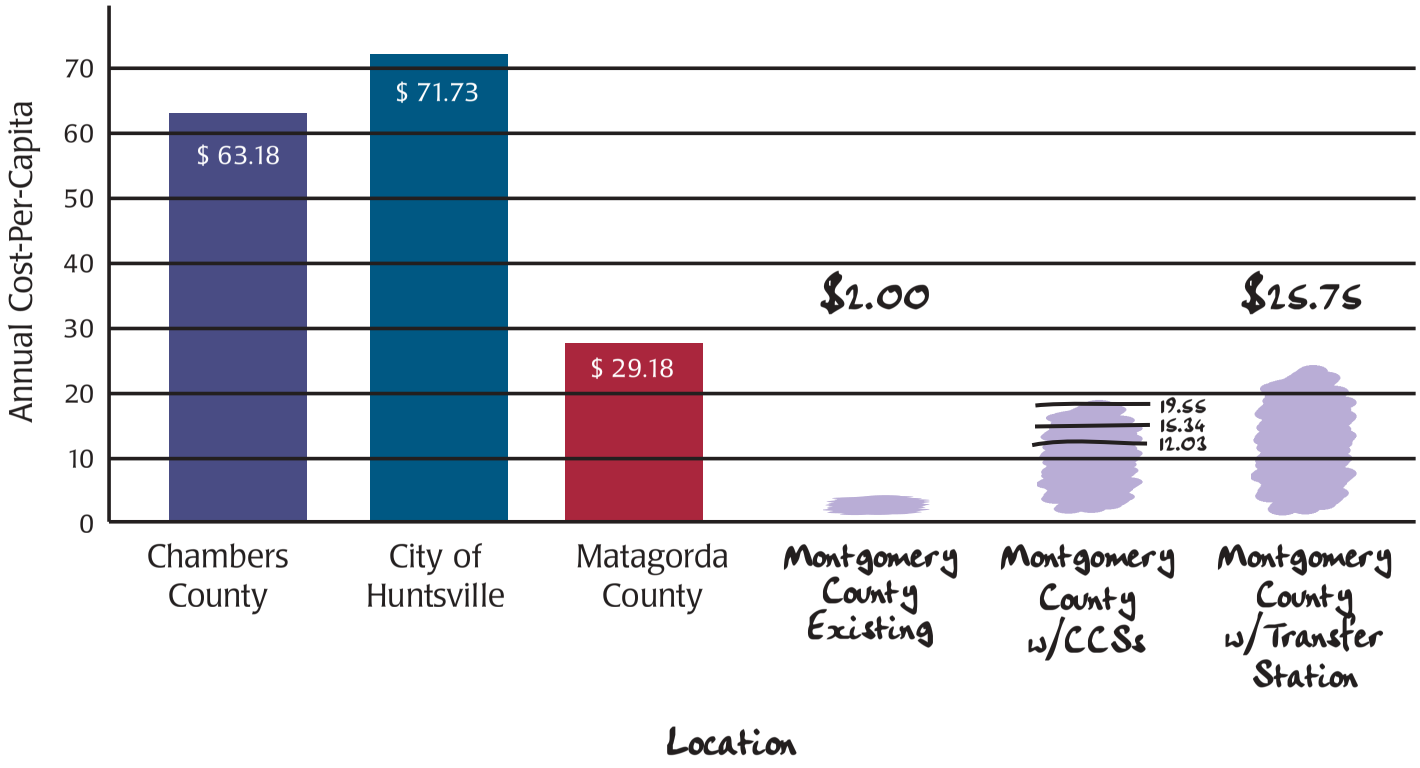
Cost Averted With The Addition Of A Transfer Station

This worksheet determines the amount of currently expended funds that would no longer be necessary with the addition of a transfer station. Review Worksheet 7 and determine what existing expenditures would be diverted. An example would be the diversion of expenditures on illegal dumping because citizens would now have a convenient and affordable means of disposing of their waste legally.

Total Cost That Could Be Diverted By Transfer Station

Landfill	$91,481
Incinerator	-
Citizens Collection Station	(NOTE 1)
Transfer Station	-
Recycling Collection	-
Residential Collection Services	-
Commercial Collection Services	-
Illegal Dumping	$15,819
Total	$107,300
Total Population Serviced By New Transfer Station	127,254
Cost-Per-Capita In Savings	$0.84

(NOTE 1) requires re-evaluation of Worksheet 8 for Each CCS.



Comparison of Transfer Station Improved Montgomery County System with Case Studies

Exhibit 27

Re-Evaluation of Montgomery County after adding Transfer Station

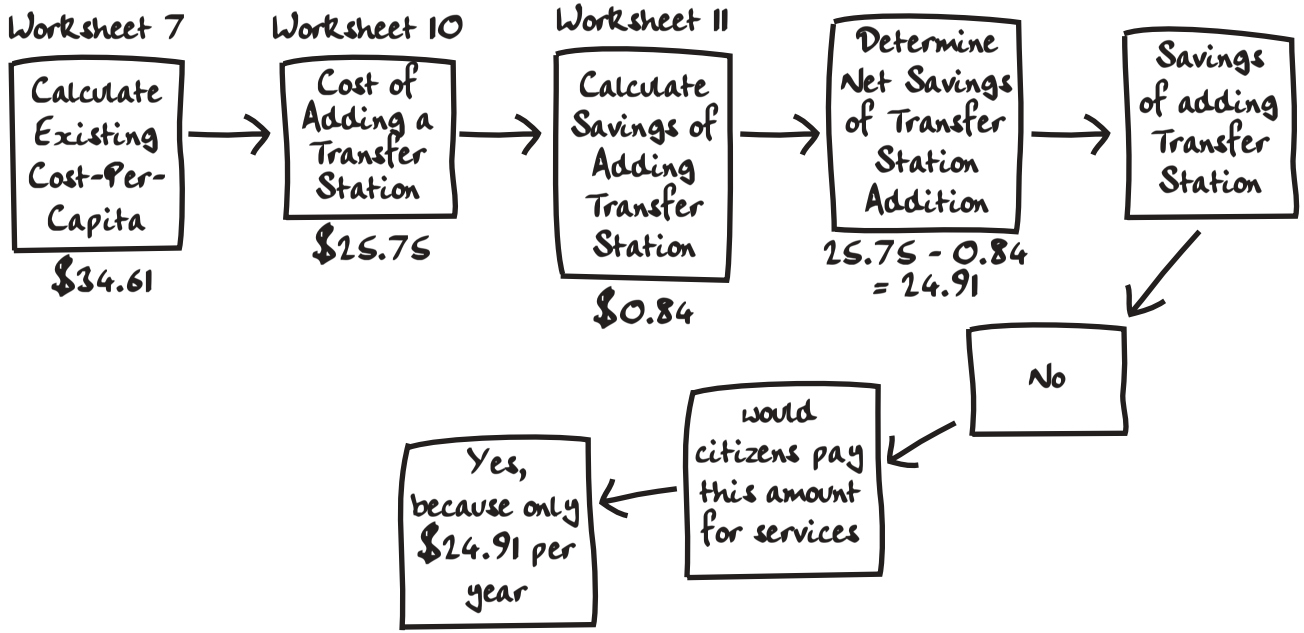


Exhibit 28

Appendix 1

GLOSSARY OF TERMS

Active disposal area - An area where solid waste has been deposited and final cover, slopes and grading have not been completed (30 TAC Section 330.2).

Avoided costs - Costs not incurred because of diversion of waste from a landfill (e.g., disposal, environmental, opportunity costs).

Brush - The cuttings or trimmings from trees, shrubs, or lawns and similar materials (30 TAC Section 330.2).

Buffer zone - Neutral area acting as a protective barrier between two non-compatible land uses. A buffer zone can act to minimize the environmental impacts including those relating to odor and visual character.

CCS - See Citizens Collection Station

C&D - See Construction-Demolition Waste

CIP - Capital Improvement Project

Citizens Collection Station (CCS) - A facility established for the convenience and exclusive use of residents (not commercial or industrial users or collection vehicles). The facility may consist of one or more storage containers, bins or trailers (30 TAC Section 330.2).

COG - Council of Governments

Collection - The act of removing solid waste (or materials which have been separated for the purpose of recycling) for transport elsewhere (30 TAC Section 330.2).

Commercial solid waste - All types of solid waste generated by stores, offices, restaurants, warehouses, and other non-manufacturing activities, excluding residential and industrial waste (30 TAC Section 330.2).

Commingled recyclables - Recyclable materials separated from mixed solid waste at point of generation; further separation into individual components occurs at collection vehicle or centralized processing facility.

Compacted waste - Waste that has been reduced in volume by a collection vehicle or other means including, but not limited to, dewatering, composting, incineration, and similar processes, with the exception of waste that has been reduced in volume by a small, in-house compactor device owned and/or operated by the generator of the waste (30 TAC Section 330.2).

Compost - The disinfected and stabilized product of the decomposition process that is used or sold for use as a soil amendment, artificial top soil, growing medium amendment or other similar use (30 TAC Section 330.2).

Composting - The controlled biological decomposition of organic material through microbial activity. Depending on the specific application, composting can serve as both a volume reduction and a waste treatment measure. A beneficial organic composting activity is an appropriate waste management solution for diverting compatible materials from the solid waste stream that cannot be recycled and converted into a useful product that can serve as a soil amendment of mulch.

Construction-demolition waste (C&D) - Waste which typically results from construction or demolition projects and includes all materials which are directly or indirectly related to by-products of construction work or result from the demolition of buildings or other structures, including but not limited to paper, cartons, gypsum board, wood, excelsior, rubber, and plastics (30 TAC Section 330.2).

Curbside collection - Collection at individual households or commercial buildings by public or private haulers, for subsequent transport to management facilities.

Discard - To abandon a material and not use, reclaim, or recycle it (30 TAC Section 330.2).

Disposal - The discharging, depositing, injection, dumping, spilling, leaking or placing of any solid waste or hazardous waste, whether containerized or uncontainerized, into or on land or water so that the solid waste or hazardous waste or any constituent thereof may be emitted into the air, discharged into the surface water or ground water, or introduced into the environment in any other manner.

Drop-off - The transport of solid waste materials or recyclables by individuals to specified area, for subsequent processing and transport to another facility.

ETJ - Extra Territorial Jurisdiction

Facility - All contiguous land and structures, other appurtenances, and improvements on the land used for the storage, processing, or disposal of solid waste (30 TAC Section 330.2).

Fixed costs - Costs that do not vary with level of output of a production facility.

Garbage - Solid waste that is putrescible animal and vegetable waste materials from the handling, preparation, cooking and consumption of food including waste from markets, storage facilities, and the handling and sale of produce and other food products.

Generator - Any person, by site or location, whose act or process produces solid waste.

Greenfield - A permitted landfill that has not accepted any waste for disposal.

H-GAC - Houston-Galveston Area Council

Hazardous waste - Any solid waste identified or listed as a hazardous waste by the administrator of the United States Environmental Protection Agency pursuant to the federal Solid Waste Disposal Act, as amended by the Resource Conservation Recovery Act (RCRA) of 1976, 42 USC. Section 6901 et seq. as amended (30 TAC Section 330.2).

Household hazardous waste (HHW) - Any solid waste classified as hazardous which is generated in a household by a consumer, such as paints, batteries, and cleaning solvents.

Household waste - Any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas); does not include yard waste or brush that is completely free of any household waste (30 TAC Section 330.2).

Incinerator - A device designed to burn that portion of garbage and rubbish, which will be consumed at temperatures of 1600 degrees Fahrenheit or higher.

Industrial solid waste - Solid waste resulting from or incidental to any process of industry, manufacturing, or mining or agricultural operations (30 TAC Section 330.2).

Integrated solid waste management - A practice of using several alternative waste management techniques to manage and dispose of specific components of the municipal solid waste stream. These alternatives may include source reduction, recycling, composting, energy recovery, and landfilling.

Leachate - Liquid that has percolated through solid waste or another medium and has extracted materials by dissolving them or carrying them in suspension.

MRF - See Material Recovery Facility

MSW - See Municipal Solid Waste

Materials recovery - The retrieval of recyclable materials from the solid waste stream.

Materials recovery facility (MRF) - A facility designed to separate recyclables from a mixed waste (dirty MRF) or commingled material supply (clean MRF).

Medical waste - Waste generated by health care related facilities or which is associated with health care activities. Includes animal waste, bulk human blood and blood products, microbiological waste, pathological waste and sharps. Trash generated from offices, kitchens, or other non-health care related activities within health care facilities is not classified as medical waste.

Mixed waste - Solid waste that is not sorted into categories of materials.

Mobile Citizens Collection Station - A designated location and time where a mobile collection vehicle will arrive to collect waste for the convenience and exclusive use of residents (not commercial or industrial users or collection vehicles).

Mobile transfer station - A facility used for transferring solid waste from collection vehicles to long-haul vehicles, where the solid waste does not touch the ground. It is transferred directly from the collection vehicle into the transfer truck.

Municipal solid waste - Solid waste resulting from or incidental to municipal, community, commercial, institutional, and recreational activities, including garbage, rubbish ashes, street cleanings, dead animals, abandoned automobiles, and all other solid waste other than industrial solid waste.

Municipal solid waste site classification (MSW) - The Texas Natural Resource Conservation Commission has classified all solid waste sites according to function and/or population equivalency served. The following is a list of the current classification system (30 TAC Section 330.41).

Type I – Disposal sites that serve 5,000 or more, or the population equivalent.

Type II – Disposal sites serving less than 5,000 persons or the population equivalent, and receiving less than 12.5 tons per day.

Type III – Disposal sites serving less than 1,500 persons or the population equivalent, and receiving less than 3.75 tons per day.

Type IV – Facility for disposal of brush, construction-demolition waste, and/or rubbish that is free of putrescible and free of household waste.

Type V – Processing plants that transfer, incinerate, shred, grind, bale, compost, salvage, separate, dewater, reclaim, and/or provide other methods for processing of solid waste.

Type VI – Facility for a new or unproven method of managing or utilizing municipal solid waste, including resource and energy recovery projects.

Type VII – Facility used for land management of sludge and/or similar waste.

Type VIII – Facilities for the management of used or scrap tires.

Type IX – A closed disposal facility or an inactive portion of a disposal facility used for extracting materials for energy and material recovery or for gas recovery.

Open burning - The combustion of solid waste without control of combustion air to maintain adequate temperature for efficient combustion, without containment of the combustion reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion, and without control of emission of the combustion products (31 TAC Section 330.5).

Participation rate - That portion of a population participating in a recycling program.

PAYT - Pay as you throw.

Point source - Any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, or discrete fissure from which pollutants are or may be discharged (31 TAC Section 330.5).

Population equivalent - The hypothetical population that would generate an amount of solid waste equivalent to that actually being managed based on a generation rate of five pounds per capita per day and applied to situations involving solid waste not necessarily generated by individuals (31 TAC Section 330.5).

Processing - Preparing individual or mixed waste materials for subsequent management, using processes such as baling, magnetic removal, or shredding.

Processing facility - A facility used to transfer, shred, grind, bale, compost, or otherwise process solid waste prior to ultimate disposal or use.

Putrescible waste - Solid waste materials, which are capable of being decomposed by microorganisms, causing odors and gases and attracting vectors.

Recyclable material - Material that has been recovered or diverted from the solid waste stream for purposes of reuse, recycling, or reclamation, a substantial portion of which is consistently used in the manufacture of products which may otherwise be produced using raw or virgin materials. Recyclable material is not solid waste. However, recyclable materials may become solid waste at such time, if any, as it is abandoned or disposed of rather than recycled.

Recycling - A process by which materials that have served their intended use or are scrapped, discarded, used, surplus, or obsolete are collected, separated, or processed and returned to use in the form of raw materials in the production of new products. Except for mixed municipal solid waste composting, that is, composting of the typical mixed solid waste stream by residential, commercial, and/or institutional sources, recycling includes the composting process if the compost is put to beneficial reuse (31 TAC Section 330.5).

Refuse - Same as rubbish (31 TAC Section 330.5).

Reuse - The use of a product more than once in its same form for the same purpose (i.e., reusable beverage containers.)

Rubbish - Nonputrescible solid waste (excluding ashes) consisting of both combustible and noncombustible waste; combustible rubbish includes paper, rags, cartons, wood, excelsior, furniture, rubber, plastics, yard trimmings, leaves, used or scrap tires, and similar materials; noncombustible rubbish includes glass, crockery, tin cans, aluminum cans, metal furniture, and like materials which will not burn at ordinary incinerator temperatures (1600 to 1800 degrees F) (31 TAC Section 330.5).

Salvaging - The controlled removal of waste materials for utilization, recycling, or sale (31 TAC Section 330.5).

Sanitary landfill - A controlled area of land on which solid waste is deposited and is disposed of in accordance with standards, rules, or orders established by the Texas Natural Resource Conservation Commission.

Scrap tire - Any tire that can no longer be used for its original intended purpose (31 TAC Section 330.5).

Small commercial haulers - Private haulers that do not use commercial solid waste vehicles for collection, but rather a flat bed trailer or similar vehicle is used.

Solid waste - Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant or air pollution control facility and other discarded material, including soil, liquid, semisolid, or contained gaseous material resulting from residential, industrial, commercial, mining and agricultural operations, and from community and institutional activities (31 TAC Section 330.5).

Solid waste management - Planning and implementation of systems to handle solid waste.

Source separation - Separation of the waste stream into recyclable components at a household or commercial establishment.

TDCJ - Texas Department of Criminal Justice

TNRCC - Texas Natural Resource Conservation Commission

Tipping fee - Price charged for delivering solid waste to disposal, collection, or recycling facility; usually expressed in dollars per ton or cubic yard.

Transfer station - A fixed facility used for transferring solid waste from collection vehicles to long-haul vehicles. It is not a storage facility such as one where individual residents can dispose of their waste in bulk storage containers, which are serviced by collection vehicles (31 TAC Section 330.5).

Variable costs - Costs that vary with the level of output of a production facility.

White goods - Large metal household appliances (e.g., stoves, dryers, refrigerators,...).

Yard waste - Leaves, grass clippings, yard and garden debris, and brush, including clean woody vegetative material. The term does not include stumps, roots, or shrubs with intact root balls.

Appendix 2

Reference Information

- Recommended Publications for Use in Implementing a CCS or Transfer Station

Illegal Dumping

Doeksen, G, Fitzgibbons, J., Goodwin, K., and G. Sloggett. **Roadside Dumping: Possible Solutions**. F-900. Oklahoma Cooperative Extension Service Division of Agricultural Sciences and Natural Resources and Oklahoma State University.

Reed-Stowe & Co., Inc. and West Environmental Consulting. 1997. **A Review of Illegal Dumping in Montgomery and Wharton Counties**. December. (for the Houston Galveston Area Council and the TNRCC). Available by phone request from H-GAC at 713-627-3200.

Slovin, J. 1995. "Communities Form Strategies Against Illegal Dumping." **World Waste**, Vol. 38, No. 1: 8.

Recycling

Brady, J. 1998. "How To Reduce Waste, Recycle, and Compost On A Shoestring Budget." In TNRCC Solid Waste Management Conference **Options For Texas Proceedings**.

Brockway, R.C., 1995. "Small Transfer Stations Prove Large in Purpose." **World Waste**, Vol. 39, No. 4: 62-66.

Doeksen, G., Fitzgibbons, J., Goodwin, K., and G. Sloggett. **Rural Community Solid Waste Recycling Systems**. F-887. Oklahoma Cooperative Extension Service Division of Agricultural Sciences and Natural Resources and Oklahoma State University.

Doeksen, G., Fitzgibbons, J., Goodwin, K., and G. Sloggett. **Rural Community Solid Waste Recycling Systems**. F-888. Oklahoma Cooperative Extension Service Division of Agricultural Sciences and Natural Resources and Oklahoma State University.

Elges, R. 1992. "Landscape Waste Diversion in Illinois: Meeting the Challenge of a Landfill Ban on Yard Waste." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

Denison, R. 1998. "Environmental Life-Cycle Comparisons Of Recycling, Landfilling, and Incineration: A Review of Recent Studies." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

Gibson, K. 1996. "Educating The Policy Makers." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

Hamlyn, E. 1995. "Conducting A Recycling Program In A Rural Setting: The Alpine Experience." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

Lehfeldt, D. 1995. "Evolution of Small Town Composting: It Can Be Done." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

Myers, C. 1996. "Contract Issues For Marketing Cooperatives." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

Overgaard, K. 1998. "Rural Recycling - The San Jacinto Experience." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

Richards, C. 1996. "Used Oil Collection Center Management Standards & Hot Load Reimbursement." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

Richter, B. 1996. "Used Oil Collection Grants." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

Shroyer, L. 1995. "Rural Recycling and Cooperative Marketing." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

Skiera, R. 1992. "Tree, Shrub, and Yard Waste Recycling." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

Skumatz, L. 1996. "Beyond Case Studies: Quantitative Effects of Recycling Program Choices." In TNRCC Solid Waste Management "Options For Texas" Conference **Proceedings**.

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